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TRANSACTIONS

OF THE

AMERICAN

SURGICAL ASSOCIATION

VOLUME THE THIRTY-FIFTH

EDITED BY

JOHN F. BINNIE, M.D.

RECORDER OF THE ASSOCIATION

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Thompson, Joseph Ford
Horsley, Sir Victor
Beckman, Emil Hessel
Czerny, Vincenz
Pilcher, Paul Monroe

OFFICERS OF THE ASSOCIATION

ELECTED MAY, 1917

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THOMAS W. HUNTINGTON, M.D.

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1608 Spruce St., Philadelphia.

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311 South Twelfth Street, Philadelphia.

TREASURER

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30 West Fiftieth St., New York City.

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127 West Seventy-second Street, New York City.

RECORDER

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Rialto Building, Kansas City, Mo.

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Ex-officio.

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RECORDER, SECRETARY, AND TREASURER, *ex-officio.*

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COMMITTEE ON NECROLOGY, CREATED IN 1884.

(Report by Title.)

F. H. GERRISH, M.D., *Chairman*
JAMES F. MITCHELL, M.D.
JOHN B. ROBERTS, M.D.

Place of next meeting:
CINCINNATI, OHIO,
JUNE 6, 7 AND 8, 1918

ADJUNCT LOCAL COMMITTEE OF ARRANGEMENTS

JOSEPH RANSOHOFF, M.D.
JOHN C. OLIVER, M.D.
EDWARD W. WALKER, M.D.

DELEGATES TO CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS, WASHINGTON, D. C., 1919

WILLIAM H. CARMALT, M.D., DELEGATE
JAMES F. MITCHELL, M.D., ALTERNATE

LIST OF THE PRESIDENTS

OF THE

ASSOCIATION FROM THE TIME OF ITS INSTITUTION

ELECTED

1880. †SAMUEL DAVID GROSS, M.D., LL.D., D.C.L (Oxon.), LL.D. (Cantab.), LL.D. (Edin.)—Founder of the Association.
1883. †EDWARD MOTT MOORE, M.D., LL.D.
1884. †WILLIAM THOMPSON BRIGGS, M.D.
1885. †MOSES GUNN, A.M., M.D., LL.D.
1886. †HUNTER McGUIRE, M.D., LL.D.
1887. †D. HAYES AGNEW, M.D., LL.D.
1888. †DAVID WILLIAMS CHEEVER, M.D., LL.D.
1889. †DAVID W. YANDELL, M.D.
1890. †CLAUDIUS HENRY MASTIN, M.D., LL.D.
1891. †PHINEAS SANBORN CONNER, M.D., LL.D.
1892. †NICHOLAS SENN, M.D., Ph.D., LL.D.
1893. JAMES EWING MEARS, A.M., M.D., LL.D.
1894. FREDERIC SHEPARD DENNIS, M.D.
1895. †LOUIS McLANE TIFFANY, A.M. (Cantab.), M.D.
1896. JOHN COLLINS WARREN, M.D., LL.D. (Jefferson), Hon. F.R.C.S. (Eng.).
1897. †THEODORE F. PREWITT, M.D.
1898. WILLIAM W. KEEN, A.M., M.D., LL.D., Hon. F.R.C.S. (Eng.).
1899. ROBERT F. WEIR, A.M., M.D., F.R.C.S. (Eng.).
1900. †ROSWELL PARK, M.D.
1901. †DE FOREST WILLARD, A.M., M.D., Ph.D.
1902. †MAURICE H. RICHARDSON, A.B., M.D.
1903. †NATHANIEL P. DANDRIDGE, M.D.
1904. †GEORGE BEN JOHNSTON, M.D.
1905. ALBERT VANDER VEER, M.D.
1906. †DUDLEY P. ALLEN, M.D., LL.D.
1907. WILLIAM H. CARMALT, M.D.
1908. C. B. G. de NANCRÈDE, A.M., M.D., LL.D.
1909. RUDOLPH MATAS, M.D.
1910. RICHARD H. HARTE, M.D.
1911. ARPAD G. GERSTER, M.D., Chir.D.
1912. CHARLES A. POWERS, A.M., M.D.
1913. WILLIAM J. MAYO, A.M., M.D., D.Sc., F.R.C.S. (Edin.), LL.D. (Tor.).
1914. GEORGE E. ARMSTRONG, C.M., M.D.
1915. ROBERT G. LeCONTE, A.B., M.D.
1916. SAMUEL J. MIXTER, S.B., M.D.
1917. THOMAS W. HUNTINGTON, A.B., M.D., LL.D.

† Deceased.

NOTICE

This volume of TRANSACTIONS contains the papers read before the Association at the Meeting held May 31, June 1 and 2, 1917.

The Association assumes no responsibility for the statements and opinions published in this volume.

FELLOWS

OF THE

AMERICAN SURGICAL ASSOCIATION

JUNE, 1917

* Denotes Original Fellows.
† Denotes Senior Fellows.
‡ Denotes Deceased Fellows.

ELECTED

†1890. ABBE, ROBERT, M.D., 13 West Fiftieth Street, New York, Surgeon to St. Luke's Hospital. *Vice-President*, 1901. *Council*, 1908.

†1890. ALLIS, OSCAR HUNTINGTON, A.M., M.D., 1604 Spruce Street, Philadelphia. Surgeon to the Presbyterian Hospital.

1902. ANDREWS, E. WYLLYS, A.M., M.D., 2525 Prairie Avenue, Chicago, Ill. Professor of Surgery, Northwestern University Medical School; Surgeon to Mercy Hospital and Michael Reese Hospital; Attending Surgeon to Cook County Hospital; Consulting Surgeon to the Provident Hospital.

1916. ARCHIBALD, EDWARD WILLIAM, B.A., M.D., C.M., 160 Metcalfe Street, Montreal, Canada. Lecturer in Clinical Surgery, McGill University; Assistant Surgeon, Royal Victoria Hospital; Associate Surgeon, Children's Memorial Hospital.

1901. ARMSTRONG, GEORGE E., C.M., M.D., LL.D. (Queens), D.Sc. (Liverpool), 320 Mountain Street, Montreal. Professor of Surgery and of Clinical Surgery, McGill University; Surgeon to the Montreal General Hospital; Surgeon to the Western Hospital, Montreal. *President*, 1914.

1913. ASHHURST, ASTLEY PASTON COOPER, A.B., M.D., 811 Spruce Street, Philadelphia. Instructor in Surgery in the University of Pennsylvania; Associate Surgeon and Orthopedist to the Episcopal Hospital; Assistant Surgeon to the Philadelphia Orthopædic Hospital and Infirmary for Nervous Diseases.

ELECTED

1917. BALFOUR, DONALD CHURCH, M.B., M.D., Rochester, Minn. Associate Professor of Surgery, University of Minnesota; Surgeon to St. Mary's Hospital, Rochester.

1906. BARROW, DAVID, M.D., 148 Market Street, Lexington, Ky.

†1882. BARTON, JAMES M., A.M., M.D., 32 North New Hampshire Ave., Atlantic City, N. J.

1915. BESLEY, FREDERIC A., M.D., F.A.C.S., 4515 Greenwood Avenue, Chicago, Ill. Professor of Surgery, Northwestern University Medical School; Attending Surgeon to the Wesley and Cook County Hospitals.

1900. BEVAN, ARTHUR DEAN, M.D., 122 S. Michigan Boulevard, Chicago. Professor and Head of the Department of Surgery, Rush Medical College, University of Chicago; Surgeon to Presbyterian Hospital.

1901. BINNIE, J. F., M.B., C.M. (Aberdeen), *Recorder*, 1334 Rialto Bldg., Kansas City, Mo. *Vice-President*, 1907.

1906. BLAKE, JOHN BAPST, A.M., M.D., 657 Boylston Street, Boston, Mass. Instructor in Surgery, Harvard Medical School; Assistant Surgeon to the Boston City Hospital; Surgeon to the Long Island Hospital and St. Elizabeth's Hospital, Boston, Mass.

1902. BLAKE, JOSEPH, M.D., 40 Avenue Henri Martin, Paris, France.

1901. BLOODGOOD, JOSEPH C., B.S., M.D., 904 North Charles Street, Baltimore, Md. Associate in Surgery in the Johns Hopkins University.

1901. BOSHER, LEWIS C., M.D., 422 East Franklin Street, Richmond, Va. Professor of Practice of Surgery, Medical College of Virginia; Visiting Surgeon, Memorial Hospital.

1913. BOTTOMLEY, JOHN T., A.B., M.D., 165 Beacon Street, Boston. Surgeon-in-Chief, Carney Hospital.

†1890. BRADFORD, EDWARD HICKLING, A.B., M.D., 133 Newbury Street, Boston. Surgeon to the Children's and the Samaritan Hospitals; Assistant Professor of Orthopedic Surgery, Harvard University.

1900. BREWER, GEORGE EMERSON, M.D., 16 East Sixty-fourth Street, New York City. Professor of Surgery in College of Physicians and Surgeons, Columbia University; Surgical Director, Presbyterian Hospital; Consulting Surgeon to the Roosevelt, City, Woman's, Manhattan Eye, Ear, Nose, and Throat Hospitals, and to the Ophthalmic and Aural Institute. *Vice-President*, 1913.

ELECTED

1917. Brewster, George W. W., A.B., M.D., F.A.C.S., 213 Beacon Street, Boston, Mass. Associate in Surgery, Harvard Graduate School; Visiting Surgeon, Massachusetts General Hospital; Consulting Surgeon to Frost Hospital, Chelsea, Mass.; Leonard Morse Hospital, Natick, Mass.; Milford Hospital, Milford, Mass.

1915. Brinsmade, W. B., A.B., M.D., 85 Montague Street, Brooklyn, N. Y. Professor of Surgery, Long Island College Hospital; Surgeon to Long Island College and St. John's Hospitals; Consulting Surgeon to St. Christopher's Hospital.

1911. Bruce, Herbert A., M.D. (Toronto Univ.), L.R.C.P. (London), F.R.C.S. (England), 64 Bloor Street East, Toronto, Canada. Associate Professor of Clinical Surgery, University of Toronto; Surgeon to the Toronto General Hospital.

1911. Buchanan, J. J., A.M., M.D., Ph.D., 1409 N. Highland Avenue, Pittsburgh, Pa. Professor of Surgery, University of Pittsburgh; Surgeon to Mercy Hospital and to Columbia Hospital.

1900. Bunts, Frank E., M.D., 1021 Prospect Street, Cleveland, Ohio. Professor of Principles of Surgery and Clinical Surgery in Medical College of Western Reserve University; Visiting Surgeon to St. Vincent's Charity Hospital; Consulting Surgeon to Cleveland City and Lutheran Hospitals.

†1885. Carmalt, William H., A.M., M.D., 261 St. Ronan Street, New Haven, Conn. Emeritus Professor of Surgery in Yale University; Consulting Surgeon to the New Haven Hospital. *President*, 1907; *Vice-President*, 1895; *Member of Council*, 1908.

1909. Carrel, Alexis, L.B., Sc.B., M.D., Rockefeller Institute for Medical Research, Sixty-sixth Street and Avenue A, New York, N. Y.

1896. Carson, Norman Bruce, M.D., 303 Humboldt Bldg., St. Louis, Mo. Professor of Clinical Surgery in the St. Louis Medical College; Surgeon to St. Louis and Mullanphy Hospitals and to the St. Vincent Insane Asylum, etc. *Vice-President*, 1903.

1916. Codman, Ernest Amory, A.B., M.D., 15 Pinckney Street, Boston, Mass.

†1896. Cole, Charles Knox, A.M., M.D., Helena, Montana. Surgeon to St. John's, St. Peter's, and County Hospitals.

ELECTED

1898. COLEY, WILLIAM B., M.D., 40 East Forty-first Street, New York. Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the Hospital for Ruptured and Crippled, New York.

1914. COTTON, FREDERICK J., A.B., M.D., A.M., 520 Commonwealth Avenue, Boston, Mass. Assistant Visiting Surgeon, The Boston City Hospital; Instructor in Surgery, Harvard School for Graduate Instruction in Medicine.

1905. CRILE, GEORGE W., M.D., 1021 Prospect Avenue, Cleveland, Ohio. Professor of Surgery, School of Medicine, Western Reserve University; Visiting Surgeon to Lakeside Hospital.

1906. CUSHING, HARVEY, A.M., M.D., The Peter Bent Brigham Hospital, Boston. Professor of Surgery, Harvard University.

†1896. CUSHING, HAYWARD WARREN, A.B., M.D., 70 Commonwealth Avenue, Boston, Mass. Junior Visiting Surgeon, Boston City Hospital; Assistant Surgeon, Children's Hospital, Boston.

1897. DA COSTA, JOHN CHALMERS, M.D., 2045 Walnut Street, Philadelphia. Professor of Surgery, Jefferson Medical College; Surgeon to the Philadelphia and the Phœnixville Hospitals.

1917. DARRACH, WILLIAM, A.B., M.A., M.D., 47 West Fiftieth Street, New York City. Professor of Clinical Surgery, College of Physicians and Surgeons; Surgical Director of First Division, Bellevue Hospital; Consulting Surgeon, Memorial Hospital, Morristown, N. J.

1916. DAVIS, CARL B., A.B., M.D., 122 South Michigan Boulevard, Chicago, Ill. Assistant Professor of Surgery, Rush Medical College; Associate Surgeon, Presbyterian Hospital, Chicago.

1909. DAVIS, GWILYM G., M.D., M.R.C.S. (Eng.), 1814 Spruce Street, Philadelphia. Associate Professor of Applied Anatomy, University of Pennsylvania; Surgeon to the Episcopal Hospital; Surgeon to St. Joseph's Hospital; Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases; Orthopedic Surgeon, Philadelphia General Hospital.

1917. DAVIS, JOHN STAIGE, Ph.B., M.D., F.A.C.S., 1200 Cathedral Street, Baltimore, Md. Instructor in Clinical Surgery, Johns Hopkins University; Visiting Surgeon, Union Protestant Infirmary, Hospital for the Women of Maryland, Children's Hospital School; Assistant Visiting Surgeon and Dispensary Surgeon, Johns Hopkins Hospital.

ELECTED

1892. DEAVER, JOHN B., M.D., 1634 Walnut Street, Philadelphia. Surgeon-in-Chief to the German Hospital, Philadelphia.

1912. DEAVER, HARRY C., M.D., 1534 North Fifteenth Street, Philadelphia. Professor of Surgery, Woman's Medical College of Pennsylvania; Surgeon-in-Chief to Kensington Hospital for Women; Surgeon to the Episcopal Hospital and to the Children's Hospital of the Mary Drexel Home.

1910. DELATOUR, H. BEECKMAN, M.D., 73 Eighth Avenue, Brooklyn, N. Y. Clinical Professor of Surgery, Long Island College Hospital; Attending Surgeon, St. John's and Norwegian Hospitals; Surgeon-in-Chief, Jewish Hospital; Consulting Surgeon, Kingston Avenue Hospital, Brooklyn, St. Mary's Hospital, Jamaica, and Hempstead Hospital.

†1882. DENNIS, FREDERIC SHEPARD, M.D., F.R.C.S. (Eng.), 62 East Fifty-fifth Street, New York. Professor of Clinical Surgery, Cornell University, New York City; Visiting Surgeon to the Bellevue and St. Vincent's Hospitals; Consulting Surgeon to St. Joseph's Hospital, Yonkers, and Montefiore Home, New York City. *President*, 1894; *Vice-President*, 1887; *Member of Council*, 1889.

1910. DOWD, CHARLES N., A.M., M.D., 127 West Seventy-second Street, New York, N. Y. Professor of Clinical Surgery, Columbia University; Attending Surgeon, Roosevelt Hospital; Consulting Surgeon, General Memorial Hospital, and St. Mary's Free Hospital for Children, New York.

1914. DOWNES, WILLIAM A., M.D., 37 West 71st Street, New York, N. Y. Assistant Professor of Clinical Surgery, Cornell Medical School; Attending Surgeon, St. Francis' Hospital; Associate Attending Surgeon to the New York, The Babies', and the Hospital for Ruptured and Crippled; Assistant Surgeon to the General Memorial Hospital.

1901. ELIOT, ELLSWORTH, JR., M.D., 34 East Sixty-seventh Street, New York. Clinical Lecturer and Demonstrator of Surgery, College of Physicians and Surgeons, New York; Surgeon to the Presbyterian Hospital.

†1893. ELLIOT, JOHN WHEELOCK, A.M., M.D. (Harvard), 124 Beacon Street, Boston. Surgeon to Massachusetts General Hospital.

1911. ELTING, ARTHUR W., A.B., M.D., 119 Washington Avenue, Albany, N. Y. Professor of Surgery in the Albany Medical College; Surgeon-in-Chief, St. Peter's Hospital, and Child's Hospital; Attending Surgeon to the Albany Hospital.

ELECTED

†1896. ESTES, WILLIAM LAWRENCE, A.M., M.D., South Bethlehem, Pa. Director and Surgeon-in-Chief of St. Luke's Hospital, Lecturer on Hygiene at Lehigh University.

1898. EVE, DUNCAN, A.M., M.D., 700 Church Street, Nashville, Tenn. Professor of Surgery and Clinical Surgery, Medical Department, Vanderbilt University; Surgeon to the Nashville City Hospital.

1899. FINNEY, JOHN M. T., M.D., 1300 Eutaw Place, Baltimore, Md. Associate Professor of Surgery, Johns Hopkins University.

1915. FLINT, JOSEPH MARSHALL, B.S., M.A., M.D., 320 Temple Street, New Haven, Conn. Professor of Surgery at Yale University.

1904. FRAZIER, CHARLES HARRISON, M.D., 1724 Spruce Street, Philadelphia, Pa. Professor of Clinical Surgery, University of Pennsylvania; Surgeon to the University Hospital.

1898. FREEMAN, LEONARD, B.S., M.D., 424 Metropolitan Building, Denver, Col. Professor of Surgery, Medical Department, University of Colorado; Surgeon to Denver City and County, St. Joseph's, and National Jewish Hospitals; Consulting Surgeon, Children's and Mercy Hospitals, Denver, Col. *Vice-President*, 1908.

1910. GAGE, HOMER, A.M., M.D., 72 Pearl Street, Worcester, Mass. Surgeon to Worcester City Hospital and to Memorial Hospital; Consulting Surgeon to St. Vincent's Hospital.

†1882. GAY, GEORGE WASHINGTON, A.M., M.D., 665 Boylston Street, Boston, Mass. Senior Surgeon to the Boston City Hospital, Clinical Instructor in Surgery in Harvard University. *Member of Council*, 1882.

†1892. GERRISH, FREDERIC HENRY, A.M., M.D. (Bowdoin), LL.D. (University of Michigan and Bowdoin), 675 Congress Street, Portland, Maine. Professor Emeritus of Surgery in the Bowdoin Medical School; Consulting Surgeon to the Maine General Hospital.

†1890. GERSTER, ARPAD G., M.D., Chir.D., 34 East Seventy-fifth Street, New York. Professor of Surgery in the New York Polyclinic; Surgeon to the German and Mount Sinai Hospitals. *Vice-President*, 1908; *President*, 1911.

1906. GIBBON, JOHN H., M.D., *Secretary*, 1608 Spruce Street, Philadelphia. Professor of Surgery, Jefferson Medical College; Surgeon to the Pennsylvania Hospital and the Bryn Mawr Hospital.

ELECTED

1906. Gibson, C. L., M.D., 72 East Fifty-fourth Street, New York, N. Y. Adjunct Professor of Surgery, Cornell University Medical College; Attending Surgeon to the First Surgical (Cornell Medical) Division of the New York Hospital; Consulting Surgeon to St. Luke's, City, and General Memorial Hospitals. *Vice-President,* 1915.

1911. Greenough, Robert B., A.B. (Harvard), M.D. (Harvard), 377 Beacon Street, Boston, Mass. Assistant Professor of Surgery, Harvard Medical School; Assistant Visiting Surgeon, Massachusetts General Hospital.

1916. Haggard, William D., M.D., F.A.C.S., 706 Church Street, Nashville, Tenn. Professor of Surgery, Vanderbilt University; Surgeon to St. Thomas' Hospital; Visiting Surgeon to Vanderbilt Hospital and Nashville City Hospital.

1909. Halstead, Albert E., M.D., 31 North State Street, Chicago, Ill. Professor of Surgery, Northwestern University Medical School; Attending Surgeon to the St. Luke's and Cook County Hospitals; Consulting Surgeon to the Illinois Charitable Eye and Ear Infirmary; Lieut., Medical Reserve Corps, U. S. Army.

†1892. Halsted, William Stewart, B.A., M.D., 1201 Eutaw Place, Baltimore, Md. Surgeon to Johns Hopkins Hospital. *Vice-President,* 1913.

1909. Hamann, Carl A., M.D., 404 Osborn Bldg., Cleveland, Ohio. Professor of Anatomy, Western Reserve University; Visiting Surgeon to Charity and City Hospitals.

1900. Harris, Malcolm L., M.D., 100 State Street, Chicago, Ill. Professor of Surgery, Chicago Polyclinic; Attending Surgeon, Alexian Brothers' Hospital, St. Luke's Hospital, and Maurice Porter Hospital for Children.

1895. Harte, Richard H., M.D., 1503 Spruce Street, Philadelphia. Associate Professor of Surgery, University of Pennsylvania; Surgeon to the Pennsylvania Hospital, and Orthopædic Hospital and Infirmary for Nervous Diseases; Consulting Surgeon to St. Mary's, St. Timothy's, and Bryn Mawr Hospitals. *President,* 1910.

1916. Hartwell, John A., Ph.B., M.D., 27 East Sixty-third Street, New York. Assistant Professor of Surgery and Professor of Clinical Surgery, Cornell University Medical College; Director of Surgery, Cornell University Division, Bellevue Hospital; Consulting Surgeon to Lincoln Hospital, Lawrence Hospital, Bronxville, N. Y., and United Hospital, Port Chester, N. Y.

ELECTED

1898. HEARN, W. JOSEPH, M.D., 1120 Walnut Street, Philadelphia. Clinical Professor of Surgery, Jefferson Medical College; Visiting Surgeon to the Philadelphia Hospital; Consulting Surgeon to the Phœnixville General Hospital.

1909. HOTCHKISS, LUCIUS WALES, A.B., M.D., 59 West Forty-eighth Street, New York. Adjunct Professor of Clinical Surgery, Columbia University; Attending Surgeon to Bellevue Hospital; Junior Surgeon to Roosevelt Hospital; Consulting Surgeon to J. Hood Wright Hospital, New York City.

†1901. HUNTINGTON, THOMAS W., A.B., M.D., LL.D., 350 Post Street, San Francisco, California. Professor of Clinical and Operative Surgery (Emeritus), College of Medicine, University of California; Consulting Surgeon, St. Luke's Hospital, San Francisco. *Vice-President*, 1906; *President*, 1917.

1909. HUTCHINSON, JAMES P., M.D., 133 South Twenty-second Street, Philadelphia. Surgeon to the Pennsylvania, Methodist, Children's, St. Timothy's and Bryn Mawr Hospitals.

1913. HUTCHISON, JAMES ALEXANDER, M.D., L.R.C.P. and S. (Edin.), 354 MacKay Street, Montreal. Professor of Surgery and Clinical Surgery, McGill University; Attending Surgeon, Montreal General Hospital.

1913. JACKSON, JABEZ N., A.M., M.D., 425 Argyle Building, Kansas City, Mo.

1901. JOHNSON, ALEXANDER B., M.D., 12 East Fifty-eighth Street, New York. Professor of Clinical Surgery, Cornell University Medical College; Attending Surgeon to New York Hospital.

1905. JOHNSON, ROBERT W., A.B., M.D., 101 W. Franklin Street, Baltimore, Md. Professor of Principles and Practice of Surgery, Baltimore Medical College; Surgeon to Maryland General Hospital, Church Home and Infirmary, and St. Agnes' Hospital.

1901. JONAS, A. F., M.D., 454 Brandeis Building, Omaha, Nebraska. Professor of Surgery, Omaha Medical College; Surgeon to the Methodist Episcopal Hospital and to the Douglas County Hospital. *Vice-President*, 1906.

1917. JONES, DANIEL FISKE, A.B., M.D., 195 Beacon Street, Boston, Mass. Associate in Surgery, Harvard Medical School; Visiting Surgeon, Massachusetts General Hospital; Con-

ELECTED

sulting Surgeon to the New England Hospital for Women and Children, Brockton City Hospital, Union Hospital of Fall River, Sturdy Hospital of Attleboro, and the Addison Gilbert Hospital of Gloucester, Mass.

1910. JOPSON, JOHN HOWARD, M.D., 1824 Pine Street, Philadelphia, Pa. Professor of Surgery, Philadelphia Polyclinic; Associate in Surgery, University of Pennsylvania; Surgeon to Presbyterian Hospital, Children's Hospital, and Bryn Mawr Hospital.

1914. JUDD, EDWARD STARR, M.D., Rochester, Minn., Surgeon to St. Mary's Hospital.

1899. KAMMERER, FREDERIC, M.D., 51 East Sixty-sixth Street, New York City. Professor of Clinical Surgery, Cornell Medical College; Surgeon to the German and St. Francis' Hospitals, New York.

1913. KANAVEL, ALLEN B., A.B., M.D., 30 North Michigan Avenue, Chicago, Ill. Assistant Professor of Surgery, Northwestern University Medical School; Attending Surgeon to Wesley and Cook County Hospitals.

*†1880. KEEN, WILLIAM WILLIAMS, A.M., M.D., LL.D., Hon. F.R.C.S. (Eng. and Edin.), 1729 Chestnut Street, Philadelphia. Emeritus Professor of the Principles of Surgery and of Clinical Surgery in the Jefferson Medical College; Surgeon to the Jefferson Medical College Hospital; Consulting Surgeon to the Woman's and St. Agnes' Hospitals; Membre Correspondant Etranger de la Société de Chirurgie de Paris; Membre Honoraire de la Société Belge de Chirurgie; Ehremitglied der Deutschen Gesellschaft für Chirurgie; Honorary Member, Clinical Society of London. *President*, 1898; *Vice-President*, 1892; *Member of Council*, 1899–1901.

1911. KILIANI, OTTO G. T., M.D., 44 West 77th St., New York City. Professor of Clinical Surgery, Columbia University; Surgeon to the German Hospital.

1916. LAW, ARTHUR AYER, M.D., F.A.C.S., 420 Syndicate Building, Minneapolis, Minn. Associate Professor of Surgery, University of Minnesota Medical School, and Mayo Foundation; Surgeon to the Northwestern Hospital; Surgeon to and Assistant Chief of the University Hospital.

ELECTED

1901. Le Conte, Robert G., A.B., M.D., 1530 Locust Street, Philadelphia. Surgeon to the Pennsylvania and the Bryn Mawr Hospitals; Consulting Surgeon to the Germantown and the Gynecean Hospitals. *President*, 1915.

1912. Lewis, Dean D., M.D., 122 S. Michigan Ave., Chicago, Ill. Assistant Professor of Surgery, Rush Medical College; Attending Surgeon to the Presbyterian Hospital, Chicago.

1910. Lilienthal, Howard, A.B., M.D., 48 East Seventy-fourth Street, New York, N. Y. Attending Surgeon, Mount Sinai Hospital; Visiting Surgeon to Bellevue Hospital; Consulting Surgeon, Hospital for Joint Diseases, Jewish Maternity Hospital, and Har Moriah Hospital.

1908. Lothrop, Howard Augustus, A.M., M.D., 101 Beacon Street, Boston, Mass. Assistant Visiting Surgeon, Boston City Hospital; Instructor in Surgery, Harvard Medical School.

1916. Lower, William E., M.D., 1021 Prospect Avenue, Cleveland, Ohio. Associate Professor of Genito-urinary Surgery, School of Medicine, Western Reserve University; Director of Surgery, Mount Sinai Hospital; Associate Surgeon in charge of Genito-urinary Surgery, Lakeside Hospital; Surgeon, Lutheran Hospital; Surgeon, White Hospital (Ravenna).

1910. Lund, Frederick Bates, M.D., 527 Beacon Street, Boston, Mass. Lecturer on Surgery, Harvard Medical School; Visiting Surgeon, Boston City Hospital.

1917. Lyle, Henry H. M., M.D., 50 East Fifty-third Street, New York City. Professor of Clinical Surgery, College of Physicians and Surgeons, Columbia University; Attending Surgeon, St. Luke's Hospital.

1901. McArthur, L. L., M.D., 122 S. Michigan Boulevard, Chicago, Ill. Professor of Clinical Surgery, Post-Graduate Medical School; Assistant Professor of Clinical Surgery, Rush Medical College; Surgeon to St. Luke's and Michael Reese Hospitals.

1882. McGraw, Theodore A., M.D., 73 Case Street, Detroit, Mich. Professor of Surgery in the Detroit Medical College; Surgeon to St. Mary's and Harper Hospitals. *Vice-President*, 1896.

1917. McGuire, Stuart, M.D., LL.D., 513 East Grace Street, Richmond, Va. Professor of Surgery, Medical College of Virginia; Surgeon in Charge of St. Luke's Hospital; Visiting Surgeon to Memorial Hospital.

ELECTED

1903. McMURTRY, LEWIS S., A.M., M.D., LL.D., 542 Atherton Building, Louisville, Ky. Professor of Gynecology and Abdominal Surgery in the Medical Department, University of Louisville; Surgeon to the Louisville City Hospital.

1915. McRAE, FLOYD W., M.D., Peters Building, Atlanta, Ga. Chief Surgeon to the Piedmont Sanatorium; Visiting Surgeon to St. Joseph's Infirmary; Consulting Surgeon to Grady Hospital.

1908. MACKENZIE, KENNETH A. J., M.D., L.R.C.P., and L.R.C.S. (Edin.), 908 Corbett Building, Portland, Oregon. Professor of Operative Surgery, Medical Department, Oregon State University; Surgeon to St. Vincent's Hospital, Portland, Oregon.

1904. MACLAREN, ARCHIBALD, M.D., B.S., 914 Lowry Building, St. Paul, Minn. Professor of Clinical Surgery, University of Minnesota. *Vice-President*, 1915.

1914. MACLAREN, MURRAY, B.A., M.B.C.M., M.D., M.R.C.S. (Eng.), 75 Coburg Street, St. John's, N. B., Canada. Surgeon to the General Public Hospital.

1898. MARTIN, EDWARD, M.D., 1506 Locust Street, Philadelphia. Clinical Professor of Surgery, University of Pennsylvania and Woman's Medical College of Pennsylvania, Philadelphia; Surgeon to Philadelphia, St. Agnes', and Howard Hospitals.

1915. MARTIN, WALTON, Ph.B., M.D., 151 East Sixty-third Street, New York. Professor of Clinical Surgery, Columbia University; Attending Surgeon, St. Luke's Hospital; Consulting Surgeon, White Plains Hospital and Loomis Sanatorium.

†1895. MASTIN, WILLIAM McDOWELL, M.D., LL.D., Northeast corner of Joachim and Conti Streets, Mobile, Ala. Surgeon to the Mobile City Hospital.

1895. MATAS, RUDOLPH, M.D., 2255 St. Charles Avenue, New Orleans, La. Professor of Surgery, Medical Department, Tulane University; Professor of Clinical Surgery, New Orleans Polyclinic; Surgeon to Charity Hospital; Consulting Surgeon to the Eye, Ear, Nose, and Throat Hospital. *President*, 1909; *Vice-President*, 1901.

1903. MAYO, CHARLES, H., A.M., M.D., LL.D., Rochester, Minn. Surgeon to St. Mary's Hospital.

1899. MAYO, WILLIAM J., A.M., M.D., D.Sc., F.R.C.S. (Edin.), LL.D. (Tor.), 427 West College Street, Rochester, Minn. Surgeon to St. Mary's Hospital. *Vice-President*, 1903; *President*, 1913.

ELECTED

*†1880. MEARS, JAMES EWING, A.M., M.D., LL.D., 1535 Land Title Building, Philadelphia. *President*, 1893; *Recorder*, 1881–93.

1901. MEYER, WILLY, M.D., 700 Madison Avenue, New York. Professor of Surgery in the New York Post-Graduate Medical School and Hospital; Attending Surgeon to the German and New York Skin and Cancer Hospitals; Consulting Surgeon to the New York Infirmary for Women and Children.

1917. MITCHELL, CHARLES F., M.D., 252 South Sixteenth Street, Philadelphia, Pa. Attending Surgeon to the Germantown and Bryn Mawr Hospitals; Out-Patient Surgeon to the Pennsylvania Hospital.

1912. MITCHELL, JAMES F., A.B., M.D., 1344 Nineteenth Street, Washington, D. C. Surgeon to Providence Hospital.

1893. MIXTER, SAMUEL JASON, S.B. (Massachusetts Institute of Technology), M.D. (Harvard), 180 Marlborough Street, Boston. Surgeon to Carney Hospital; Consulting Surgeon to Massachusetts General Hospital and to Massachusetts Charity Eye and Ear Infirmary; Instructor in Surgery, Harvard University.

†1896. MONKS, GEORGE HOWARD, A.B. (Harvard), M.D. (Harvard), M.R.C.S. (Eng.), 51 Commonwealth Ave., Boston. Junior Visiting Surgeon, Boston City Hospital; Lecturer on Surgery, Harvard Medical School and Harvard Dental School.

†1895. MOORE, JAMES E., M.D., 616 Syndicate Bldg., Minneapolis, Minn. Professor of Surgery, University of Minnesota; Surgeon-in-Chief to the Northwestern Hospital. *Vice-President*, 1905.

1914. MOSCHCOWITZ, ALEXIS V., M.D., 925 Madison Ave., New York, N. Y. Associate Surgeon, Mt. Sinai Hospital, Attending Surgeon, Hor Moriah Hospital.

1904. MUDD, HARVEY G., M.D., Humboldt Building, St. Louis, Mo. Professor of Fractures and Dislocations and Clinical Surgery, Medical Department, Washington University; Surgeon to St. Luke's Hospital; Consulting Surgeon to the St. Louis City Hospital.

1913. MURPHY, FRED T., A.B., M.D., Washington University Medical School, St. Louis, Mo. Professor of Surgery, Washington University Medical School; Surgeon-in-Chief, Washington University Hospital and St. Louis Children's Hospital.

ELECTED

†1898. Murray, Francis W., M.D., 32 West Thirty-ninth Street, New York City. Professor of Clinical Surgery in Cornell University Medical College; Surgeon to the New York and St. Luke's Hospitals.

†1882. de Nancrède, C. B. G., A.M. (University of Pennsylvania), M.D., LL.D. (Jefferson), 504 South State Street, Ann Arbor, Mich. Professor of Surgery in the University of Michigan; Professor of Surgery, Dartmouth Medical College. *President*, 1908; *Vice-President*, 1889 and 1899.

1903. Neilson, Thomas R., M.D., 1937 Chestnut Street, Philadelphia, Pa. Surgeon to the Episcopal Hospital and to St. Christopher's Hospital for Children; Clinical Professor of Genito-urinary Diseases in the University of Pennsylvania.

1915. Nichols, Edward Hall, A.B., A.M., M.D., 294 Marlborough Street, Boston, Massachusetts. Associate Professor of Surgery, Harvard University Medical School; Senior Visiting Surgeon, Boston City Hospital; Consulting Surgeon, City Hospital, Quincy, and Framingham Hospital, Framingham.

1900. Ochsner, A. J., B.S., F.R.M.S., M.D. (Eng.), 710 Sedgwick Street, Chicago. Professor of Clinical Surgery, College of Physicians and Surgeons; Surgeon-in-Chief of Augustana and St. Mary's Hospitals.

1900. Oliver, J. C., M.D., 628 Elm Street, Cincinnati, Ohio. Dean and Professor of Operative Surgery, Miami Medical College; Surgeon to Cincinnati, Presbyterian, and Christ Hospitals.

1915. Olmsted, Ingersoll, M.B., 215 James Street, South, Hamilton, Ontario. Surgeon to City Hospital.

†1882. Owens, John E., M.D., 1017–18 Venetian Building, Chicago, Ill. Professor of Principles and Practice of Surgery and Clinical Surgery in the Chicago Medical College; Surgeon to St. Luke's Hospital. *Vice-President*, 1900.

1899. Parham, Frederick William, M.D., 741 Carondelet Street, New Orleans, La. Professor of General, Clinical, and Operative Surgery on the Cadaver, New Orleans Polyclinic; Surgeon to Charity Hospital; Consulting Surgeon to Eye, Ear, Nose, and Throat Hospital.

ELECTED

†1893. PARMENTER, JOHN, M.D., 519 Franklin Street, Buffalo, N. Y. Professor of Anatomy and Clinical Surgery in the Medical Department of the University of Buffalo; Surgeon to the Sisters of Charity, Erie County, Fitch, Children's, and Emergency Hospitals; Assistant Surgeon to the Buffalo General Hospital.

1908. PECK, CHARLES HOWARD, M.D., *Treasurer*, 30 West Fiftieth Street, New York City. Associate in Surgery, Columbia University; Attending Surgeon to French Hospital; Junior Attending Surgeon to Roosevelt Hospital.

1917. PHEMISTER, DALLAS B., B.S., M.D., 122 South Michigan Avenue, Chicago, Ill. Instructor in Surgery, Rush Medical College; Associate Attending Surgeon, Presbyterian Hospital.

†1889. PILCHER, LEWIS S., A.M., M.D., LL.D. (Dickinson), 145 Gates Avenue, Brooklyn, N.Y. Professor of Clinical Surgery in the Post-Graduate Medical School, New York; Surgeon to the Methodist Episcopal Hospital, New York. *Vice-President*, 1893.

1914. PLUMMER, SAMUEL C., A.B., M.D., 4539 Oakenwald Avenue, Chicago, Ill. Attending Surgeon, St. Luke's Hospital; Clinical Professor of Surgery, Northwestern University Medical School; Chief Surgeon, C. R. I. & P. Ry. Co.

1914. POOL, EUGENE HILLHOUSE, A.B., M.D., 107 East 60th Street, New York, N. Y. Attending Surgeon, French Hospital; Associate Attending Surgeon, New York Hospital; Instructor of Surgery, Columbia University; Consultant Surgeon to New York Orthopædic and Manhattan State Hospitals, and Home for Incurables.

1904. PORTER, CHARLES ALLEN, A.M., M.D., 245 Beacon Street, Boston, Mass. Assistant Surgeon to the Massachusetts General Hospital; Instructor in Surgery, Harvard Medical School.

1915. PORTER, MILES FULLER, M.A., M.D., 207 West Wayne Street, Fort Wayne, Ind. Professor of Surgery in the Indiana University School of Medicine; Surgeon-in-Chief to Hope Hospital; Consulting Surgeon in the Indiana School for Feeble-minded Youths.

†1896. POWERS, CHARLES A., A.M., M.D., Metropolitan Building, Denver, Col. Professor of Clinical Surgery, Emeritus, in the University of Colorado, and Surgeon to St. Luke's Hospital and to the Children's Hospital; Consulting Surgeon to the Denver City and County Hospital, to the Mercy Hospital, and to the State Home for Children. *President*, 1912; *Vice-President*, 1903; *Treasurer*, 1906–1912; *Member of Council*, 1906–1916.

ELECTED

1908. PRIMROSE, ALEXANDER, M.B., C.M. (Edin.), M.R.C.S. (Eng.), 100 College Street, Toronto, Canada. Surgeon to the Toronto General Hospital and to the Hospital for Sick Children, Toronto; Associate Professor of Clinical Surgery in the University of Toronto.

1886. RANSOHOFF, JOSEPH, M.D., F.R.C.S. (Eng.), 19 West Seventh Street, Cincinnati, Ohio. Professor of Anatomy in the Medical College of Ohio; Surgeon to the Cincinnati and the Good Samaritan Hospitals. *Vice-President*, 1911.

1901. RIXFORD, EMMET, B.S., M.D., 1795 California Street, San Francisco, Cal. Professor of Surgery in Cooper Medical College; Surgeon to City, County, and Lane Hospitals. *Vice-President*, 1905.

†1882. ROBERTS, JOHN B., A.M., M.D., 313 South Seventeenth Street, Philadelphia. Professor of Anatomy and Surgery in the Philadelphia Polyclinic; Surgeon to the Methodist and Jewish Hospitals. *Vice-President*, 1888 and 1894; *Treasurer*, 1892–93.

1914. ROSS, GEORGE GORGAS, M.D., 1721 Spruce Street, Philadelphia, Pa. Visiting Surgeon, Germantown Hospital; Assistant Surgeon, German Hospital.

1917. ROWAN, CHARLES J., A.B., M.D., Iowa City, Iowa. Professor and Head of Department of Surgery, College of Medicine, State University of Iowa; Director of the University Hospital.

†1882. RUSHMORE, JOHN DIKEMAN, M.D., 129 Montague Street, Brooklyn, N. Y. Professor of Surgery in the Long Island College Hospital; Surgeon to the Brooklyn, St. Peter's, and the Eye and Ear Hospitals.

1909. SCUDDER, CHARLES L., M.D., A.B., Ph.B., 209 Beacon Street, Boston, Mass. Assistant Professor of Surgery, Harvard Medical School; Chief of the East Surgical Service, Massachusetts General Hospital.

†1902. SHEPHERD, FRANCIS J., M.D., 152 Mansfield Street, Montreal, Canada. Professor of Anatomy and Lecturer on Operative Surgery in McGill University, Montreal; Senior Surgeon to the Montreal General Hospital.

1905. SHERMAN, HARRY M., A.B., M.D., A.M., 350 Post Street, San Francisco, Cal. Professor of Surgery in the University of California; Surgeon to St. Luke's Hospital, San Francisco; Orthopedic Surgeon to the Children's Hospital, San Francisco.

ELECTED

†1895. SOUCHON, EDMOND, M.D., 2403 St. Charles Avenue, New Orleans, La. Professor of Anatomy and of Clinical Surgery, Tulane University; Surgeon to Charity Hospital; Consulting Surgeon to the Eye, Ear, Nose, and Throat Hospital. *Vice-President*, 1899.

1914. STARR, FREDERIC NEWTON GISBORNE, M.B., M.D.C.M., 112 College Street, Toronto, Canada. Associate Professor of Clinical Surgery, University of Toronto; Surgeon to Hospital for Sick Children, and to St. John's Hospital for Women; Senior Assistant Surgeon, Toronto General Hospital.

1911. STEWART, FRANCIS T., M.D., 311 S. 12th Street, Philadelphia, Pa. Professor of Clinical Surgery, Jefferson Medical College; Surgeon to Germantown Hospital; Out-patient Surgeon, Pennsylvania Hospital.

1915. STEWART, GEORGE DAVID, M.D., 61 West Fiftieth Street, New York. Professor of Surgery, New York University Medical School; Visiting Surgeon to St. Vincent's and Bellevue Hospitals; Consulting Surgeon to Hospital for Ruptured and Crippled of New York, to St. Joseph's Hospital, Yonkers, to St. Mary's Hospital, East Orange, N. J., to South Side Hospital, Babylon, L. I., and to Englewood Hospital, Englewood, N. J.

1909. STILLMAN, STANLEY, M.D., 2101 Webster Street, San Francisco, Cal. Professor of Surgery, Cooper Medical College; Surgeon to Lane Hospital and City and County Hospital.

1912. STOKES, CHARLES F., A.M., M.D., D.Sc., LL.D., Washington, D. C. Surgeon-General, United States Navy.

1909. SUMMERS, JOHN EDWARD, M.D., 618 Brandeis Theatre Bldg., Omaha, Neb. Surgeon to the Clarkson Memorial, the Wise Memorial, and the Douglass County Hospitals, Omaha, Neb.

1900. TAYLOR, WILLIAM J., M.D., 1825 Pine Street, Philadelphia. Surgeon to the Orthopædic Hospital and Infirmary for Nervous Diseases, and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women.

1916. TERRY, WALLACE I., B.S., M.D., 240 Stockton Street, San Francisco, Cal. Professor of Surgery, University of California; Chief Surgeon, University of California Hospital, San Francisco.

ELECTED

1909. Thompson, James E., M.D., 3224 Broadway, Galveston, Texas. Professor of Surgery in the University of Texas Medical School; Surgeon to the John Sealy Hospital.

†1882. Vander Veer, Albert, A.M., M.D., Ph.D., LL.D., 28 Eagle St., Albany, N. Y. Professor of Surgery, Albany Medical College; Surgeon-in-Chief, Albany Hospital; Consulting Surgeon, Albany Free Dispensary Association; Consulting Surgeon, Benedictine Hospital, Kingston, N. Y., and Champlain Valley Hospital, Plattsburgh, N. Y.; *President*, 1905; *Vice-President*, 1898; *Member of Council*, 1907.

1910. Vander Veer, Edgar Albert, Ph.B., M.D., 28 Eagle Street, Albany, N. Y. Clinical Professor of Surgery, Albany Medical College; Attending Surgeon, Albany Hospital; Consulting Surgeon, Champlain Valley Hospital.

1902. Vaughan, George Tully, M.D., 1718 I Street, Washington, D. C. Professor of Principles and Practice of Surgery, Georgetown University; Professor of Surgery and Genito-urinary Surgery, Washington Post-Graduate Medical School; Chief Surgeon, Georgetown University Hospital; Surgeon, Emergency Hospital; Consulting Surgeon, Government Hospital for the Insane, Washington, D. C.; Assistant Surgeon-General, U. S. Public Health and Marine Hospital Service.

1891. Walker, Edward W., M.D., 30 Garfield Place, Cincinnati, Ohio. Professor of Surgery, Miami Medical College.

1909. Walker, John B., M.D., 50 E. Thirty-fourth St., New York, N. Y. Surgeon to the Bellevue Hospital; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York.

†1882. Warren, John Collins, M.D., LL.D. (Jefferson), Hon. F.R.C.S. (Eng.), 58 Beacon Street, Boston, Mass. Professor of Surgery in Harvard University; Surgeon to the Massachusetts General Hospital. *President*, 1896; *Vice-President*, 1890; *Member of Council*, 1897.

†1896. Watson, Francis Sedgwick, A.B., M.D., 92 Marlborough St., Boston. Surgeon to the Boston City Hospital; Instructor in Genito-Urinary Surgery, Harvard Medical School.

1913. Watts, Stephen H., M.A., M.D., Department of Surgery, University of Virginia, Charlottesville, Va. Professor of Surgery and Gynecology in the University of Virginia; Surgeon-in-Chief, University of Virginia Hospital.

ELECTED

†1889. WEIR, ROBERT F., A.M., M.D., Hon. F.R.C.S. (Eng.), Cor. Mem. Surg. Soc., Paris, 11 East Fifty-fourth Street, New York. Professor of Surgery in the College of Physicians and Surgeons, Columbia University; Surgeon to the Roosevelt Hospital. *President*, 1899; *Member of Council*, 1893–1896; 1901–03.

†1892. WHARTON, HENRY R., A.M., M.D., 1725 Spruce Street, Philadelphia. Surgeon to the Presbyterian, Children's, and Methodist Hospitals.

1914. WINSLOW, RANDOLPH, A.B., M.D., A.M., LL.D., 1900 Mt. Royal Terrace, Baltimore, Md. Professor of Surgery, University of Maryland; Chief Surgeon, University Hospital; Surgeon, Hebrew Hospital; Consulting Surgeon to Union Hospital, Elkton, Md., and to James L. Kernan Hospital for Crippled Children, Baltimore.

1901. WOOLSEY, GEORGE, M.D., 117 East Thirty-sixth St reet, New York City. Professor of Anatomy and Clinica[1] Surgery, Cornell University; Surgeon to Bellevue Hospital; Associate Surgeon to the Presbyterian Hospital.

1916. YATES, J. L., Ph.B., B.S., M.D., F.A.C.S., 141 Wisconsin Street, Milwaukee, Wis. Professor of Clinical Surgery, Marquette University; Chief of Surgical Staff, Milwaukee County Hospital; Consulting Surgeon, Johnson Emergency Hospital.

SENIOR FELLOWS OF THE ASSOCIATION

ABBE, ROBERT, M.D., 13 West Fiftieth Street, New York.
ALLIS, OSCAR H., M.D., 1604 Spruce Street, Philadelphia, Pa.

BARTON, JAMES M., M.D., 32 North New Hampshire Ave., Atlantic City, N. J.
BRADFORD, E. H., M.D., 133 Newbury Street, Boston, Mass.

CARMALT, WILLIAM H., M.D., 261 St. Ronan St., New Haven, Conn.
COLE, CHARLES KNOX, A.M., M.D., Helena, Montana.
CUSHING, HAYWARD WARREN, A.B., M.D., 70 Commonwealth Ave., Boston, Mass.

DENNIS, FREDERIC SHEPARD, M.D., F.R.C.S. (Eng.), 62 East 55th Street, New York, N. Y.

ELLIOTT, JOHN WHEELOCK, A.M., M.D., 124 Beacon Street, Boston, Mass.
ESTES, WILLIAM LAWRENCE, A.M., M.D., South Bethlehem, Pa.

GAY, GEORGE W., 665 Boylston Street, Boston, Mass.
GERRISH, FREDERIC H., A.M., M.D., LL.D., 675 Congress Street, Portland, Me.
GERSTER, ARPAD G., M.D., Chir.D., 34 East Seventy-fifth Street, New York, N. Y.

HALSTED, WM. STEWART, M.D., 1201 Eutaw Place, Baltimore, Md.
HUNTINGTON, THOMAS W., A.B., M.D., LL.D., 350 Post Street, San Francisco, Cal.

KEEN, W. W., A.M., M.D., LL.D., 1729 Chestnut Street, Philadelphia, Pa.

MASTIN, WM. M., M.D., Northeast corner Joachim and Conti Streets, Mobile, Ala.
MEARS, JAMES EWING, A.M., M.D., LL.D., 1535 Land Title Building, Philadelphia, Pa.

MONKS, GEORGE H., A.B., M.D., M.R.C.S., 51 Commonwealth Avenue, Boston, Mass.

MOORE, JAMES E., M.D., 616 Syndicate Building, Minneapolis, Minn.

MURRAY, FRANCIS W., M.D., 32 West Thirty-ninth Street, New York, N. Y.

DE NANCRÈDE, C. B. G., A.M., M.D., LL.D., 504 South State Street, Ann Arbor, Mich.

OWENS, JOHN E., M.D., 1201 Venetian Building, Chicago, Ill.

PARMENTER, JOHN, M.D., 519 Franklin Street, Buffalo, N. Y.

PILCHER, LEWIS S., A.M., M.D., LL.D., 145 Gates Avenue, Brooklyn, New York.

POWERS, CHARLES A., A.M., M.D., Metropolitan Building, Denver, Colo.

ROBERTS, JOHN B., A.M., M.D., 313 South Seventeenth Street, Philadelphia, Pa.

RUSHMORE, JOHN D., M.D., 129 Montague Street, Brooklyn, N. Y.

SHEPHERD, FRANCIS J., M.D., 152 Mansfield Street, Montreal, Canada.

SOUCHON, EDMUND, M.D., 2103 St. Charles Ave., New Orleans, La.

VANDER VEER, A., A.M., M.D., Ph.D., LL.D., 28 Eagle Street, Albany, N. Y.

WARREN, J. COLLINS, M.D., 58 Beacon Street, Boston, Mass.

WATSON, FRANCIS S., A.B., M.D., 92 Marlborough Street, Boston, Mass.

WEIR, ROBERT F., M.D., 11 East Fifty-fourth Street, New York, N. Y.

WHARTON, HENRY R., A.M., M.D., 1725 Spruce Street, Philadelphia, Pa.

HONORARY FELLOWS OF THE ASSOCIATION

ELECTED

1907. Ballance, Charles Alfred, M.D., M.S., University of London, F.R.C.S. (Eng.), 106 Harley Street, London.

1891. Chiene, John, F.R.C.S. (Edin.), M.D. (Edin.), 26 Charlotte Square, Edinburgh, Scotland. Professor of Surgery in the University of Edinburgh.

1916. Depage, Prof. Dr. Antoine, Le Panne, Belgium.

1911. von Eiselsberg, Freiherr Anton, Vienna, Austria. Professor of Surgery, Vienna University.

1916. Gorgas, William C., Surgeon-General, A.B., M.D., Sc.D., LL.D., War Department, Washington, D. C.

1894. Kocher, Prof. Dr. Theodor, 25 Villette, Berne, Switzerland. Professor of Surgery, University of Berne.

1894. Macewen, Sir William, M.D., M.B., M.S., 3 Woodside Crescent, Glasgow, Scotland. Professor of Surgery, The University, Glasgow.

1908. Moynihan, Sir B. G. A., M.S. (Lond.), F.R.C.S., 33 Park Square, Leeds, England. Surgeon to the Leeds Infirmary,

1907. Myles, Sir Thomas, M.D., F.R.C.S.I., 33 Merrion Square. N., Dublin, Ireland.

1907. Pozzi, Professor S., Avenue de Jena, Paris, France. Professor of Surgery, University of Paris.

1903. Robson, A. W. Mayo, C.V.O., M.D., F.R.C.S., D.Sc., 8 Park Crescent, Portland Place, London, W., England. Vice-President, Royal College of Surgeons of England; Hunterian Professor of Surgery and Pathology.

ELECTED

1882. SMITH, STEPHEN, A.M., M.D., LL.D., 574 Madison Avenue, New York. Professor of Clinical Surgery in the University Medical College of New York; Surgeon to the Bellevue and St. Vincent's Hospitals. *Vice-President*, 1890.

1912. STILES, HAROLD JALLAND, M.B., F.R.C.S. (Edin.), 9 Great Stuart Street, Edinburgh, Scotland. Surgeon to Chalmers Hospital and to the Royal Edinburgh Hospital for Sick Children, Edinburgh.

1914. THOMSON, ALEXIS, B.M., M.S., M.D., (Edin.), M.R.C.S. (Eng.), 39 Drumsheugh Gardens, Edinburgh, Scotland. Professor of Surgery, University of Edinburgh.

1907. TRENDELENBURG, PROF. DR. F., Leipzig, Germany. Professor of Surgery, University of Leipzig, Germany.

DECEASED FELLOWS OF THE ASSOCIATION

Name	Date of death
Agnew, D. Hayes	March 22, 1892
Allen, Dudley Peter	January 6, 1915
Annandale, Thomas	1907
Ashhurst, John, Jr.	July 7, 1900
*Atlee, John Light	October 1, 1885
Beckman, Emil Hessel	November 7, 1916
Benham, Silas Nelson	November 3, 1890
*von Bergmann, Ernst	Died since 1906 Meeting
*Bigelow, Henry Jacob	October 30, 1890
*Billings, John Shaw	March 11, 1913
*Billroth, Albert Christian Theodor	January 5, 1894
Bontecou, R. B.	1906–1907
Briggs, William Thompson	June 13, 1894
Brinton, John Hill	March 18, 1908
Bristow, Algernon Thomas	March 26, 1913
Brock, Hugh W.	April 24, 1882
Bryant, Joseph Decatur	April 7, 1914
*Bryant, Thomas	1914–1915
Bull, William Tillinghast	February 22, 1909
Burrell, Herbert Leslie	1910
Byrd, William Andrew	August 14, 1887
Cabot, Arthur Tracy	November 4, 1912
Campbell, Henry Fraser	December 15, 1891
Cheever, David Williams	December 27, 1915
Conner, Phineas Sanborn	March 26, 1909
Cunningham, Francis Deane	September 11, 1885
*Czerny, Prof. Dr. Vincenz	October 3, 1916
Dandridge, Nathaniel P.	1911–1912
Davis, John Staige	July 18, 1885
Dawson, William Wirt	February 16, 1893
Dugas, Louis Alexander	October 19, 1884
Dunn, James Henry	June 16, 1904
Dunott, Thomas Justus	May 20, 1893
*Durham, Arthur Edward	May 7, 1895

* Honorary.

Name	Date of death
*Erichsen, Sir John Eric	September 23, 1896
*von Esmarch, Friedrich	1907
Fenger, Christian	March 7, 1902
Ferguson, Alexander Hugh	October 20, 1911
Forbes, William Smith	December 17, 1905
Fowler, George Ryerson	February 6, 1906
*Friedrich, Paul Leopold	January 5, 1916
Gaston, James McFadden	November 17, 1903
Greene, W. Warren	September 10, 1881
Gross, Samuel David	May 6, 1884
Gross, Samuel Weissel	April 16, 1889
Gunn, Moses	November 4, 1887
*Gussenbauer, Karl	June 19, 1903
Guthrie, George Washington	June 1, 1915
Harrington, Francis B.	1914–1915
*Harrison, Reginald	1907
Hodge, H. Lenox	June 16, 1881
Hodgen, John T.	April 28, 1882
Homans, John	February 7, 1903
*Horsley, Sir Victor Alexander, C. B.	July 16, 1916
Horwitz, Orville	January 28, 1913
*Horwitz, Phineas J.	September 28, 1904
Hughes, J. C.	August 10, 1881
*Humphrey, Sir George Murray	September 24, 1896
*Hunt, William	January 5, 1897
Jacobson, Nathan	September 16, 1913
Johnston, George Ben	1917
Johnston, Christopher	October 11, 1891
King, Alfred	June 4, 1916
Kinloch, Robert Alexander	December 23, 1891
Lane, Levi Cooper	February 18, 1902
*von Langenbeck, Bernhardt	September 30, 1887
Levis, Richard J.	November 12, 1890
*Lister, Joseph	February 11, 1912
Little, James Lawrence	April 4, 1885
Lutz, Frank Joseph	March 24, 1916

* Honorary.

Name	Date of death
McCann, James	1893
McCosh, Andrew J.	1908–1909
McGuire, Hunter	September 19, 1900
*MacCormac, Sir William	December 4, 1901
MacDonald, Willis Goss	December 30, 1910
MacMonagle, Beverly	May 22, 1912
Markoe, Francis Hartman	1907
Marks, Solon	1916
Mastin, Claudius Henry	October 3, 1898
Michael, J. Edwin	December 7, 1895
*Mikulicz-Radecki, John V.	
Miles, Albert B.	August 5, 1894
Millard, Perry H.	February 1, 1897
Miller, Truman W.	May 31, 1900
*Moore, Edward Mott	March 3, 1902
Mudd, Henry Hodgen	November 20, 1899
Mumford, James Gregory	October 18, 1914
Murphy, John B.	1915–1916
Norris, Basil E.	October, 1895
*von Nussbaum, J. N.	October 31, 1890
*Ollier, Leopold	1900–1901
Oviatt, Charles W.	October 31, 1912
*Paget, Sir James	December 30, 1899
Pancoast, William H.	January 5, 1897
Park, Roswell	February 15, 1914
*Parker, Willard	April 25, 1884
Parkes, Charles T.	March 28, 1891
Parkhill, Clayton	January 16, 1902
*Péan, Jules E.	January 30, 1898
Peck, Washington F.	December 30, 1891
Pilcher, Paul Monroe	January 4, 1917
Porter, Charles Burnham	May 21, 1909
Porter, William Gibbs	January 30, 1906
Prewitt, Theodore F.	October 17, 1904
Prince, David	December 10, 1880

* Honorary.

Name	Date of death
Reed, Thomas Baird	April 1, 1891
Richardson, Maurice Howe	July 31, 1912
Richardson, Tobias Gibson	May 26, 1892
Rodman, William Louis	March 8, 1915
Sabine, Thomas Taunton	August 23, 1888
Sayre, Lewis A.	1900–1901
*Schede, Max	1902
Senn, Nicholas	January 2, 1908
*Sims, J. Marion	November 13, 1883
Squire, Truman Hoffman	November 27, 1889
*Terrier, Louis Felix	1908
*Thiersch, Karl	April 28, 1895
Thompson, Joseph Ford	February 1, 1917
Thompson, Joseph W.	March 30, 1886
Thomson, William	August 3, 1907
Tiffany, Louis McLane	October 23, 1916
Varick, Theodore Romeyn	November 23, 1887
*Verneuil, Aristide A. S.	June 11, 1895
*von Volkmann, Richard	November 28, 1889
Watson, Beriah Andrew	December 22, 1892
Weeks, Stephen Holmes	September 1, 1909
Weist, Jacob Rowland	May 14, 1900
*Wells, Sir Thomas Spencer	January 31, 1897
White, James William	April 24, 1916
Wight, Jarvis S.	November 16, 1901
Willard, DeForest	October 14, 1910
Wood, James R.	May 4, 1882
*Yandell, David Wendell	May 2, 1898

* Honorary.

REPORT OF COMMITTEE ON NECROLOGY

ALFRED KING

Alfred King, oldest son of Marquis Fayette and Frances Olivia (Plaisted) King, was born on the second of July, 1861, in Portland, Maine, which was his home during his entire life. After obtaining his preparatory education in the public schools of his native city, he entered Colby College, and was graduated from it with the degree of A.B. in 1883. He immediately began his professional studies, and received the doctorate in medicine from the Bowdoin Medical School in 1886. He established himself in practice at once in Portland. On October 26, 1887, he married Miss Nellie Grace True, of Waterville, who survives him. In the Maine General Hospital he rose through the various ranks to the highest place on the staff, being house doctor in the year before his graduation, supplying a place suddenly made vacant by death; adjunct surgeon 1890–91; visiting surgeon from 1891 to his resignation in 1907; and, on his retirement from the active staff, he was elected to the consulting board. In 1904 he established a private hospital, which he conducted with great satisfaction and advantage; and in connection with it he maintained a training school for nurses. His capacity as a teacher found scope in the Bowdoin Medical School, in which he held successively the positions of demonstrator of anatomy, instructor in anatomy, associate professor of anatomy, assistant professor of clinical surgery, lecturer on surgery, and professor of surgery—the last office from 1912 until his death. In all of these places he displayed typical ability and devotion, which were particularly conspicuous in the surgical professorship, which he filled more ably and usefully than any of his predecessors in it, though some of them had more than national reputations. In addition to his highly prized fellowship in this Association, he was a member of the International Society of Surgeons, the American Therapeutic Society, the medical societies of his county, State, and Nation, and select private organizations in the profession of his city. Although so hard a worker in his profession, he was keenly alive to his duties as a citizen, and took an active part in politics, local and

national; but he never sought an office for himself. His chief recreation was in practical agriculture, and he brought to the management of his farm the acumen and scientific spirit that was exhibited in all of his work, with the result that his establishment was a model for and the wonder of all the surrounding country. The papers, which he contributed to medical societies, displayed deep thought and originality; but he published few of them. In 1910 his Alma Mater conferred upon him the honorary degree of Doctor of Science. He kept at work until two days before his death, which occurred June 4, 1916, from septic pneumonia, originating in a dental abscess.

This recital of the principal events in the life of Dr. King, while impressing one with an idea of the importance of his brilliant career, gives but a mere suggestion of the nature, the character, and the personality of the man—all of which were factors in determining the splendid results achieved. His phenomenal success cannot seem wonderful to anybody who properly appreciates his attributes. The very sight of him prepossessed one in his favor—his unusual height, the erectness and solidity of his figure, betokening great bodily strength, the manly beauty of his face, the kindness and intelligence that beamed from his eyes—all combined to produce a most favorable impression, which subsequent acquaintance abundantly confirmed. His manner was dignified, but engaging, and inspired confidence, which events proved was not misplaced. His voice was low and gentle, and never betrayed excitement, however deeply his emotions were stirred. Strong feelings he certainly had, and sometimes he experienced urgent provocation to wrath; but his self-control was always sufficient to preserve his philosophic calmness of demeanor, however great the incentive to anger. He seemed to have no room in his big nature for envy, jealousy or uncharitableness. Though at times the victim of malice, he entertained no hatred for his enemies. But, though so gentle in spirit, he had most positive ideas on matters of moment, and did not hesitate to express his convictions with firmness. To a cause that he espoused his devotion was absolute—no effort, of which he was capable, was too great for him to make. His loyalty to his friends was touching and beautiful; and those who survive him will cherish the memory of it with gratitude and affection to their last days. His generosity was unbounded, his helpfulness of disposition constantly manifested. The breadth of his interests and the depth of his knowledge on a large number of subjects were remarkable. His long service in the teaching of anatomy, particularly in the dissecting room, and his practical knowledge of pathology were the best possible preliminaries to the understanding of surgical problems; and to these he added manipulative skill of the highest order. Marvelous

celerity was a striking feature of his operations; but every step was taken with a surety that indicated perfect familiarity with the ground to be traversed. In a marked degree he displayed self-reliance; but this had in it no element of conceit. He had in mind what he wanted to accomplish, his learning and experience lighted the way to the desired result, and he knew his own capability. But where something new and valuable was to be acquired, the modesty of no one could be more evident than his in the presence of any man who could teach him. It was delightful to see his eagerness for truth. His capacity for work and his fondness for it were almost incredible; and these traits were his final undoing, for he gave himself unsparingly wherever his help was required, and this lavish expenditure of his energies so weakened his system that when acute disease attacked him the power of resistance was inadequate, and he succumbed to the assault. Honors were plentifully bestowed upon him in recognition of his work and achievements; but plaudits and distinctions never evoked from him a sign of pride: they seemed to him mere incidents, which he valued only to the extent that they enlarged his opportunities for usefulness. Well may the profession and the community mourn over the loss of this gifted, honorable, lovable citizen, so exceptionally endowed and equipped for the noblest service, and so unselfishly devoted to the interests of humanity! F. H. G.

JOSEPH FORD THOMPSON

Joseph Ford Thompson was born in Maryland, March 20, 1837, and died in Washington, D. C., February 1, 1917. He was educated in the public and private schools of St. Mary's County, Md., and at Rittenhouse Academy, Washington, and was graduated in medicine, in 1857, from the University of Maryland. He began practice in Washington, and, after fifty years of activity, retired in 1907. In 1860 he married Virginia Grieves, by whom he had three children: Joseph Ford, Jr., Mrs. R. I. Waddell, of Westchester, Pa., and Mrs. M. V. McArdle, wife of Dr. Thomas E. McArdle, of Washington.

June, 1862, Dr. Thompson was appointed an acting assistant surgeon in the United States Army, and remained in the military service until August, 1865. Resuming his practice in Washington, he soon became known as a prominent surgeon, and was professor of surgery for thirty-five years in Columbia University, and attending surgeon, at various times, to Providence, Emergency, Children's, Garfield, and Columbian (later George Washington) University

Hospitals, and consulting surgeon to others. He twice visited the surgical clinics of Europe for study and observation, and studied under Billroth, at Vienna. On his third trip to Europe, November, 1906, he was operated upon by Mayo Robson—a gastro-enterostomy for ulcer of the stomach—and, although temporarily relieved, he died from the trouble or one of its sequelæ more than ten years after.

He held membership in many medical and surgical societies, notably the American Medical Association and American Surgical Association, and was an honorary member of the Washington Surgical Society and of the Medical Society of the District of Columbia. He was a member of the latter society for more than fifty-two years, and it was here that most of his contributions to surgical science were made, chiefly in the form of clinical reports and discussions.

March 7, 1907, the local society gave him a dinner, largely attended, in honor of his 70th birthday, and the fiftieth year of his graduation in medicine.

Dr. Thompson was the most distinguished surgeon of his time in Washington and its vicinity. He was a good lecturer, fluent, forceful, and convincing. His manners were abrupt, but evidently honest and sincere. His nature was magnanimous—there was nothing of the petty jealousy sometimes seen among physicians. He was frank, fair, fearless, and forceful in all his transactions. His charity and kindness of heart were well known to thousands of patients, who received the benefit of his skilful services free of charge. His aim was, first of all, to cure his patient; his fee was of minor consideration, if considered at all. His life was useful, and his influence and example were for good.

G. T. V.

SIR VICTOR HORSLEY, C.B., F.R.S., F.R.C.S., M.B., M.S.

Victor Alexander Haden Horsley, whom a critical medical historiographer calls "the greatest Hunterian surgeon of his day," died in his fifty-ninth year, July 16, 1916. He was serving as colonel of the British Army Medical Corps on a mud-flat of the Tigris River, under a shade temperature of 110° to 120° F., in the midst of cholera, dysentery, and similar endemic diseases of that Mesopotamian region. He had previously, as captain and major, seen professional service with the British forces at Gallipoli and in Egypt. Six weeks before his death his sovereign had conferred upon him the C.B. order for distinguished service in the field.

An illness of only twenty-four hours terminated the career of this valued Honorary Fellow of the American Surgical Association. Death was due to heat-stroke, causing a bodily temperature of 110° F., with accompanying coma. No autopsy was made, though subsequently it was found that in England, Sir Victor, with characteristic, scientific forethought, had directed by will that such investigation should be made whenever life ended. He was buried in Amara on the Tigris with military honors.

As will be anticipated, Horsley's last days were spent not merely in surgical amelioration of the bodily ailments of the troops, but in a characteristically earnest effort to lessen their sufferings, resulting from official lack of medico-economic foresight. This activity was shown by his letter, dated July 5, received after his death by the editor of the *British Medical Journal*.

Those familiar with his long attention to medical sociology in England, and his personal vigor in combating hygienic and other public neglects, will not be surprised at this evidence of his unending belief in personal effectiveness.

Sir Victor was born in 1857 of English parentage, well known in artistic circles. After a university education he graduated bachelor of medicine in 1881. He enthusiastically adopted the teachings of Lister, who had moved from Scotland to London about the time of Horsley's entrance into medical life. The young surgical aspirant was soon made professor of pathology in University College and later professor of clinical surgery. In 1886 he was elected surgeon to the National Hospital for the Paralyzed and Epileptic. This position gave him ample opportunity to utilize the neurological facts familiar to him from original laboratory observations in his physiological laboratory at University College. The safety of Listerian methods furnished him means of confirming the possibility of removing with success cerebral and spinal tumors, a phase of surgical endeavor with which his name will ever maintain illustrious connection.

It was at this time that he, in company with Dr. Ferrier, made a visit to the United States, where he at once gained the sincere admiration of many American surgeons. The brilliancy of his laboratory investigations, continued until 1913, the value of his clinical application of their results, and his cordial simplicity in his own land made him especially attractive to Americans in his subsequent career.

His establishment of the relation of myxedema to complete surgical removal of the thyroid gland, the suggestion of thyroid grafting as a remedy, and his official connection with the work of the British Hydrophobia Committee were later evidences of his scientific interest

and acumen. He was elected Fellow of the Royal Society in 1886, and knighted in 1902.

It is, perhaps, impossible for American colleagues to form a just estimate of the effects and value of Sir Victor's medico-political efforts. It must be admitted, however, that the sincerity and zeal for reforms, which led to his adoption of unpopular lines of action, appeal to many as evidences of his loyalty to the medical profession and of his belief that its members are protectors of the public health.

The numerous prizes received by him, and the honorable positions held at home and abroad are ample testimony that his life was widely recognized as a productive and useful one. Gentleness, patient precision, manual dexterity, and knightly humaneness and boldness were qualities well known to his immediate circle. His assertive dogmatism in opposing alcohol-drinking and his insistent endeavor to right public wrongs may have concealed from his critics the sincerity and earnest love of justice of a great man. The boundless energy that did much for the medical profession and its individual members will not soon be forgotten.

The death of Victor Horsley is a blighting result of war, not to be overlooked in future estimates of its tragedies. J. B. R.

EMIL HESSEL BECKMAN

Emil Hessel Beckman was born February 15, 1872, at Grundy Center, Iowa. He was graduated from Iowa College, at Grinnell, Iowa, in 1894, with the degree of B.P. After four years of service in the public schools as a teacher of Latin and Greek and as high school principal, he entered the College of Medicine and Surgery of the University of Minnesota, from which he was graduated in 1901. During his senior year in medicine he served as intern in the City and County Hospital of St. Paul, Minnesota. In July, 1901, he became an assistant bacteriologist in the laboratory of the Minnesota State Board of Health, at the State University, a position which he held for four years. Much of his time was spent in investigating epidemics of diphtheria, smallpox, scarlet fever, etc., a work for which he was especially adapted. With Wesbrook, Wilson, and McDaniel he was engaged in researches on the types and distribution of the Bacillus diphtheriæ, the means of isolating and identifying the Bacillus typhosus from various sources, and hemorrhagic septicemia in domestic animals. His taste for surgery may have developed in the large amount of experimental work on animals done during these investigations.

In July, 1905, he was appointed city physician in Minneapolis, thus being placed in charge of the city hospital. In addition to his duties as superintendent, he held a gynecological service, which gave him an opportunity to obtain some experience in surgery. After a year and nine months in this position, he left it to accept work in the Mayo Clinic, April 1, 1907.

Dr. Beckman's first position in the Mayo Clinic was that of first assistant to Dr. C. H. Mayo. This post he held for four years. Early he evinced the keen clinical and surgical judgment, which stood him so well in hand when later he became the head of Surgical Section 4 in the Mayo Clinic, his position at the time of his death. Here his work excited the admiration of all who saw it. His fine intuition guided him clearly along the difficult path of decision as to when to withhold and when to use his rare skill for the best interest of his patient. While his work covered the field of general surgery, his splendid technic was most evidenced in fine dissections of the cervical region in the presence of tuberculosis and cancer, in the correction of deformities of the nose and mouth, and in operations on the thorax, lungs, brain, spinal cord, and nerve ganglia.

Dr. Beckman both spoke and wrote clear, correct, and forceful English. During the nine and a half years he was in the Mayo Clinic he became the author of thirty scientific papers.

Dr. Beckman was a member of the Olmsted County (Minnesota) Medical Society, the Southern Minnesota Medical Association, the Minnesota State Medical Society, the Minnesota Academy of Medicine, the Colorado State Medical Society, the American Medical Association, the Interurban Surgical Association (of which he was president at the time of his death). He was head of Section 4 of the Surgical Division of the Mayo Clinic, and associate professor of surgery on the Mayo Foundation of the University of Minnesota. He was president of the Olmsted County (Minnesota) Automobile Club, a director of the Rochester Commercial Club, and a member of the Royal Arch Masons.

January 1, 1902, he was married to Miss Jessie Sayre, of Odebolt, Iowa. He was the father of two children, Catherine, aged eleven, and Ruth, aged seven.

Dr. Beckman was taken sick October 31, 1916, with an infection of Staphylococcus pyogenes aureus. The infection began on his nasal septum, rapidly spread to the other structures of the head, and then became general, causing his death at 10 P.M., November 7, 1916, after eight days' illness.

His desire to do the very best possible for the good of his patients, to keep fully abreast of the literature of his profession, to be the

devoted companion of his wife and children, and to fulfil in the largest measure his duties as a citizen of the community in which he lived, combined to drive him at a speed constantly approaching the limit of his physical capacity. There is no doubt that when sickness came his resisting power was not high. His death was due not to infection alone, but to the strenuous work of a none too strong physique.

He will ever remain to those who knew him well as an ideal in every walk of life, be it as citizen, surgeon, or friend; and to them his loss is irreparable. A brave, honest, and generous man, with strong intellect and absolute devotion to principle, he always endeavored to elevate his profession and constantly labored to advance its interests. Broad-minded and singularly free from narrow prejudice, his strong personality inspired trust, confidence, and love in all with whom he came in contact. W. J. M.

VINCENZ CZERNY

WHOEVER has visited German university clinics in the latter part of the last century and the first years of the present one tried not to miss "Czerny of Heidelberg." Under this brief title he was known among medical men all over the world. For more than twenty-five years he adorned the chair of surgery of this old "alma mater," and then took the Directorship of the Institute for Cancer Research, the first of its kind in Germany, which he held until the time of his death.

Vincenz Czerny died in his seventy-fifth year October 3, 1916. He was born in Trautenau, Bohemia, November 19, 1842, as the third son of a druggist, who trained his children early to lead a simple and healthful life. While still on the gymnasium, Czerny showed a keen interest for botanical and zoölogical collections and practised the use of the magnifying glass and the microscope. Destined to follow in his father's footsteps, he made use of his vacation time to learn the practice of a pharmacist.

However, soon his inclination toward the natural sciences prevailed, and in 1860 he entered the University of Prag as a student of medicine. One year later he settled in Vienna, where he worked under Bruecke. Every free moment was utilized for the furtherance of his personal inclination for histological investigations, particularly that of tumors, but also of the healthy and diseased eye. Soon he became the private assistant of the renowned Prof. Arlt, in which capacity he devoted much time to comparative ophthalmological studies, and published several articles dealing with this subject.

During the war of 1866 he worked in the cholera wards in Vienna, and soon after received his medical degree, "summa cum laude." After a brief stay in Hebra's dermatological clinic, and then with Oppolzer, he became the assistant of Billroth in 1868. In the scientific atmosphere of this clinic he gradually changed his chosen field of experimental histology with surgical topics. Whereas the first publication from his new sphere of work dealt with the structure of the spleen, regeneration of nerves and skin transplantation, he soon devoted his energy to work on the resection of the esophagus and stomach and the extirpation of the larynx, which latter operation he was the first successfully to perform. Still, the microscopic study of tumors remained his favorite chapter.

At the beginning of the war of 1870 he was surgeon in the German army for a brief time. After his return to Vienna, in the summer of 1871, he qualified as instructor. Hardly six months later, in December of the same year, when only twenty-nine years old, he was called as full professor of surgery to fill this chair at the University of Freiburg. Here, with a comparatively small sphere of action and a limited number of beds, he again found time besides his clinical work for his favorite study of experimental and histological surgery. He published important original articles on tumor transplantation into the anterior chamber of the eye, colonic absorption, intestinal suture, herniotomy, the treatment of bone and joint tuberculosis, and of urethral fistulæ, fat embolism, osteitis deformans, etc. Additional inspiration he derived from being associated with men like Kussmaul, his future father-in-law, Nothnagel, Langerhans and others.

Six years later, in 1877, he was called to Heidelberg to succeed Gustav Simon, who had just died. Here he at once found big opportunities. It took but a short time, and his fame as a great, keen diagnostician and a splendid, skilful, and fearless operator spread beyond the boundaries of his fatherland. His favorable reports on gastro-enterostomy, resection of the stomach and intestines, gall-bladder and bile-duct surgery, on the extirpation of the larynx, spleen, kidney, and uterus, which latter he was the first to remove by the vaginal route, on ovariotomy and myotomy, ventrofixation of the uterus, plastic operations, and so forth—reports usually made at the annual meetings of the "Deutsche Gesellschaft f. Chirurgie"—soon brought him a large consultation practice. His clinical work kept him incessantly and intensively busy, so much so that he found little time for literary work of his own. Although he contributed a large number of observations and collective reports on important topics to medical literature, he never found the time for writing a more

comprehensive monograph on any one of the many special chapters of surgery, the scientific and technical points of which were so thoroughly at his command. He used to express his personal regret for this omission with a remark that he could "handle the knife better than the pen." Still the articles published by him number more than one hundred and sixty. The large and valuable material of his clinic was further worked up by the great number of his gifted and splendid assistants, every one of whom was continuously stimulated by his wonderful leadership. Many of these men occupy important positions at universities and hospitals today.

Czerny's clinics were renowned all over the world. Medical men of every nationality could be seen in his audience summer and winter. One could not help being impressed by his kind, sympathetic and confidence-inspiring manner with his patients, his acuteness in diagnosis, his bold and aggressive, masterful, yet conservative, technic.

As in all other large medical institutions of the world the evolution and results of antisepsis and asepsis were observed with the keenest interest and enthusiasm, and every new advance tested by immediate introduction and practical experimentation. Although his operative results had been most satisfactory under perfected antiseptic regime, he showed his progressive temperament by promptly substituting for it strictest asepsis, after the latter had been so convincingly demonstrated to the medical world by von Bergmann before the International Medical Congress at Berlin, in 1890.

When after more than twenty-five years of hard work he considered it best to lay down the duties of his high office and leave the directorship of the clinic, which had been enlarged and rebuilt according to his personal wishes and plans, the time of recuperation and absolute rest was but brief. Instinctively his mind turned again toward his favorite theme, the study of malignant tumors, particularly that of carcinoma. During his entire clinical career as a teacher and chief of a large institute he persistently had directed the attention of his assistants and pupils toward the study of this difficult problem, because he did not find the leisure to devote his own time to it. Just then in the beginning of the twentieth century the campaign against cancer started also in Germany. Czerny at once became the leading figure in it. He visited the cancer hospitals of Moscow and Buffalo —the latter, unfortunately, during the summer, at the time of the St. Louis Exposition—and then set about founding an Institute for Cancer Research in Heidelberg. With his devotion and energy he succeeded in overcoming all difficulties and obstacles. In October, 1906, the new institute was opened and soon commenced to flourish.

In a great number of articles, more than forty, he laid down his own ideas of this terrible scourge; more than one hundred and fifty were contributed by his collaborators. He personally leaned toward the infectious theory of carcinoma.

At the beginning of the present world war Czerny converted the Institute for Cancer Research into a military hospital, and served as a surgeon in the army, for the third time in his life. Unfortunately, fate did not allow him to see the end of the gigantic struggle. A treacherous illness undermined the strength of his system, which had been constantly overtaxed by the hardships of his manifold duties.

It was but natural that to a personality like that of Czerny the appreciation and high regard, in which he was held everywhere, was shown him by his profession, the government, and the host of friends and admirers in many ways. In 1877 he was called to the vacated chair of surgery in the University of Prag; in 1882, to that of Wuerzburg; and in 1894 to that of Vienna, to succeed Billroth. But he declined every one of them. He was elected President of the "Deutsche Gesellschaft f. Chirurgie" (1901), later one of its Honorary Fellows, Prorector of Heidelberg University (1902), President of the International Surgical Congress (1908), and of the International Association for Cancer Research (1910); of the latter he continued to be Honorary President. He was made an Honorary Fellow of the American Surgical Association in 1885, and in the course of years of many other medical and surgical societies and scientific academies. In 1903 he was elevated to the rank of Real Privy Medical Councillor ("Wirklicher Geheimrat"), with the title of Excellency.

However, more than these many tokens of universal appreciation and esteem he cherished the many successes he had obtained in his specialty, and the love and gratitude of innumerable patients he had cured.

The name Vincenz Czerny will live forever in the annals of the surgical art and of cancer research. W. M.

PAUL MONROE PILCHER

Paul Monroe Pilcher, A.M., M.D., was born in Brooklyn, N. Y., April 11, 1876, and died January 4, 1917. He was the son of Lewis Stephen Pilcher, M.D., and Martha Phillips Pilcher. He was educated at the Brooklyn Polytechnic Institute, and in 1898 received the degree of B.S. from the University of Michigan. He began his medical

education there, and continued it at the College of Physicians and Surgeons, New York, where he received the degree of M.D. in 1900. In the same year Columbia College conferred upon him the degree of M.A. He then entered the Methodist Episcopal Hospital, where he served two years as an intern in the services of medicine and surgery. On the completion of his hospital service Dr. Pilcher continued post-graduate studies in the Universities of Göttingen, Vienna, and Berlin.

On returning to Brooklyn he was associated with his father in the practice of surgery, devoting himself more especially to the diagnosis and surgical treatment of diseases of the bladder, ureter, and kidney. In this he was eminently successful, and rapidly became known as a leader in this branch of surgery. His *Practical Cystoscopy* was one of the earlier works published in this country on this subject, and was soon recognized as an authoritative work. Dr. Pilcher followed the father in the development of literary work, and his contributions to surgery were many and valuable.

He was a member of the important local medical societies and of the American Medical Association, American Urological Society, and a Fellow of the American College of Surgeons. He was president of the Brooklyn Pathological Society in 1912, and of the Society of ex-Interns of the Methodist Episcopal Hospital in 1910. At the 1916 meeting of the American Surgical Association he was elected to membership; but his untimely death prevented the Association's receiving the benefit of his Fellowship.

Dr. Pilcher married Miss Mary Finlay in April, 1905. His widow and two sons, Lewis S. Pilcher and Paul M. Pilcher, survive him.

H. B. D.

ADDRESS OF THE PRESIDENT

By SAMUEL J. MIXTER, M.D.
BOSTON, MASS.

You have honored me by choosing me to be your President, the highest honor that can come to an American surgeon. My appreciation of that honor is all the greater because it is more than I deserve for work accomplished, and is a mark of your affection and esteem, of your feeling that I have at least tried to "do my bit" in bringing American surgery to the position it occupies today. Gentlemen, I thank you with all my heart.

In these days of war and peril, of struggle of right against wrong, of awful waste of human happiness and human life, when we are just preparing to fight for our lives and all that is near and dear to us and humanity, the medical profession must do its part.

A year ago our President, Dr. Le Conte, urged upon us and the country the necessity of medical preparedness, but how little of the necessary work has yet been done. The army needs, and must have, young, hospital-trained medical men to care for the troops to be used in this country and abroad, and these men must have special training for their work if they are to serve efficiently. It is our duty as older men to aid in this movement. Let each one of us try to do his part in securing enlistments either to the medical corps of the army or to the medical department of the Officers' Reserve Corps.

All honor to those members of our Association and other medical bodies who are now working at home or abroad, helping

to throttle the rabid beast of the world, the bite of whose poisoned fangs can only be cured by one antitoxin. Now, if never before, we strive for Peace with Victory. Some are now "somewhere in France," more are going with hundreds of younger men to work for those of us who are forced to stay behind, facing dangers that we cannot share.

The death-rate in the medical corps has always been high, but it is bound to be higher, for it has remained to be the crowning shame of ruthlessness and Germany that a supposed civilized nation refuses to recognize the cross on the arm or on the side of a hospital ship, sending wounded men and Red Cross nurses to the same death to which they sent that splendid woman, our friend and companion, Marie Depage. The greater the danger the greater the honor, and we know that our doctors and our nurses will not be found wanting, but ready to face danger whenever and however it comes, whether from disease, shot and shell, or the viper of the sea.

What has all this to do with "conservatism," which is the theme of this paper? Much—everything. War is the highest type of conservatism when it is waged in the defense of our homes and the rights of humanity. Nations, like surgeons, must resort to steel to accomplish their beneficent purposes, and the one who uses it hesitatingly or inefficiently through inadequate training or cowardice, spreads broadcast the germs of physical or moral disease.

War being a fact, and not a theory, each one of us must ask what he can do to help toward a speedy and successful end. What can those of us do who are debarred by age, physical disabilities, or other reasons from taking the active part that we might wish? The absence of so many of the younger and more active men will throw on us services that we thought we had finished in hospital and private practice. The sick must be cared for, the young so treated that they grow up strong and lusty to take their part when the time comes and the possible mothers so strengthened that they may bear healthy children to supply the place of those brave men and women who will be

lost to the nation. There will be hard work and plenty of it for us all.

One very important subject for careful thought and action is the prevention of venereal disease, the curse of armies and navies the world over, but especially to be feared when young soldiers are brought together in mobilization and training camps, as shown in the present war and our late experience on the Mexican border. Every effort should be made to guard our men so that they may be kept well and efficient, and return home clean and healthy. Shot, shell, and exposure are not the only means by which an army may be weakened. In this connection I feel that it is highly important for our Association to take some formal action urging the abrogation of the patents on salvarsan, a remedy at present practically unobtainable, though absolutely necessary for the present and future treatment of syphilis.

At a time like this, what more fitting topic of thought can we have than conservatism—when everything tends toward exaggeration?

New problems are facing the surgeon in civil as well as in military life, as they always have and always will—and our old foes sepsis, tuberculosis, and malignant disease still claim their victims in peace as well as in war. We are fighting them hard, but we must fight them still harder if we expect to win. Popular education in the early recognition of suspicious symptoms, laboratory and bedside study, early, thorough and judicious operation, are today the best weapons we possess, and let us use them to the best of our ability.

Advances in surgery are made slowly, step by step, through careful observation, experiment, and skilful manipulation – seldom by isolated brilliant dashes. It was my privilege to see the first, in fact, the first sixteen litholapaxies of Bigelow. Even the first operation was brilliantly successful and the onlooker could hardly believe that it was the first, everything went so smoothly and successfully. It was only after looking over all the discarded apparatus, the great number of anatomical preparations and experiments, that one could understand the reason

for the success. That first operation was the result of months and years of hard mental and manual labor. No matter how brilliant the idea, if crudely and carelessly carried out it cannot be expected to bring success. I have always looked upon the preliminary work of Bigelow in perfecting his operation as one of the greatest lessons of my life, and it is to be regretted that the whole collection of broken, twisted, and discarded steel, rubber, and glass, the plaster casts of the bladder, with the various instruments in place, could not have been preserved and their history written for the benefit of those who would try short cuts in surgery.

In the program for this meeting there are papers on the treatment of intestinal stasis; in fact, the subject comes up at nearly every large surgical meeting, a sure sign that perfect success has not been attained. Because the intestine could be removed or sidetracked and the patient still live, men having seen or heard of certain cases (successful or early reported as such), whether they were possessed of the necessary surgical skill and judgment or not, began to try all sorts of mechanical tricks with the offending organ, with the net result of a few cures and many failures. Do not understand me as condemning such operations *in toto*, for in suitable cases a properly selected surgical proceeding may be useful or necessary, but let it be carefully thought out and carefully executed. Few of us are guiltless of mistakes in this field of work. We have followed too blindly and enthusiastically in the footsteps of the first explorers, have worked by rule of thumb instead of being thoughtful and caretaking.

Working by any fixed set of rules is sure to be followed by disaster. There is practically no surgical rule that should not occasionally be broken. It is better to open the trachea with a dirty knife and unclean fingers than have a person choke to death; it is better to leave an occasional septic appendix or gall-bladder to drain, even if we believe in their routine removal —and this is where that something called "surgical judgment" comes in. Many a brilliant operator is a poor surgeon. A man

should never let his deft fingers tempt him to useless or unnecessary work. This is so often done in the treatment of advanced malignant disease, and the result is either the death of the patient—which is not to be so much regretted perhaps—or he is left after unnecessary pain, both mental and physical, in a worse state than before. Fortunately, we have *x*-rays and radium to suggest, as they may relieve the pain and other symptoms in certain cases, even if they do not cure, and there is plenty of morphin in the world that may be used judiciously and freely toward the last. Too often an operation is done because the patient insists upon it and against the better judgment of the surgeon.

The results of the discovery of the curative value of the *x*-rays and radium is a good example of the danger of a non-conservative use of a valuable remedial agent. They were hailed as cure-alls in the treatment of malignant disease, and we all know of cases of even beginning cancer of the breast that were *x*-rayed to death when a thorough operation would probably have saved the patients. Misdirected enthusiasm ran wild, and I can today repeat the statement that I have made before, that, so far as they were used for the cure of malignant disease, more lives were lost than would have been the case had *x*-rays never been discovered. Let us hope that this statement may not be made of radium and of serum therapy. How often has a new remedy or method of great value in itself been discovered and published to the world, and then when adopted by would-be followers or imitators the result has been disaster to patients and the discredit of the method.

Within our own time what a long list of misused surgical and remedial methods could be compiled. Normal ovariotomy, so-called, unsexed thousands of women for whom relief from every known ill from dysmenorrhea to epilepsy was sought, and today the appendix is removed for the relief of symptoms due to trouble in some other organ which from lack of knowledge or due care has been overlooked. There are bound to be in every profession men who are careless, untrained, overenthusiastic, and rash.

The "near surgeon," to use a favorite term of one of our members, is a dangerous man, and by example, precept, and teaching he must be raised to a higher level. All men have not the same minds, hands, or hearts, and even the best can always learn and advance if they will, for there is no such thing as standing still. With the broadening of the surgical field many more surgeons are needed than in the past, and all young men cannot have what we may call an ideal training but must work ahead as best they may amid unfavorable surroundings, mental and physical. Some of these men become better surgeons than those who have had every advantage, for some men never become real surgeons no matter how many operations they may do. The question of the incompetent or conscienceless surgeon is one of most vital interest today and one whose solution it will be hardest to find.

Conservatism in surgery means the best use in our power of the means at hand for the saving of life, the relief of pain and deformity, without unnecessary mutilation. The man who is timid, the man who is rash, are alike far from being conservative—amputation when necessary to save life may be the highest form of conservation, and if it is best to amputate at or above the knee for gangrene the foot alone should not be taken off because the shock is less and the immediate mortality lower.

Timidity in the treatment of malignant disease is a common fault, the highest type of cowardice. True conservatism means going to the "anatomical jumping-off place," for no death is more to be dreaded than that from recurrence. Above all is he a knave as well as a coward who refuses to operate on a desperate case, when life may perhaps be saved, for the sake of his "statistics"—for statistics which have morally damned many an otherwise good surgeon, had better be juggled in some other way or even lied about. The true surgeon is never "fearless." He fears for his patients, he fears for his own shortcomings and mistakes, but never fears for himself or his professional reputation. His fear makes him a better man.

In the course of a somewhat busy professional life I have found

my standard of the true surgeon growing ever higher and higher, and even to a body of picked men such as this it is not out of place to speak of the ideal, for who among us has attained or ever will attain the goal toward which he strives. Were it not for the unattainable the world would indeed be a poor place. Those qualities that make the true man in any walk of life are doubly necessary to the making of the real surgeon.

> "Self-reverence, self-knowledge, self-control,
> These three alone lead life to sovereign power,
> Yet not for power (power of herself
> Would come uncalled for) but to live by law
> Acting the law we live by without fear;
> And, because right is right, to follow right
> Were wisdom in the scorn of consequence."

The present meeting of the Association promises to be small numerically; so many of our members having already gone to the front or are soon to go. We have lost our Secretary, our Treasurer, and many others who are working for us and ours. What better men could we have to represent us and our country, knowing as we do that they are good men and true, real surgeons, ready to do their part and more, for the right. We hope and trust that we may all be together at future meetings in happier and more peaceful years, those already back from the front, those now at their posts, those still to go, and those who are left at home. Our next meeting may be smaller yet, so let us train ourselves and the younger men that the line across the sea shall never be broken until we have

Peace with Victory.

ANGULATION AT THE SIGMOID

By H. BEECKMAN DELATOUR, M.D., F.A.C.S.
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The sigmoid flexure is the narrowest part of the colon, beginning at the termination of the descending colon at the margin of the crest of the ilium and ending in the rectum opposite the left sacro-iliac symphysis. It is retained in place by a loose fold of peritoneum, the sigmoid mesocolon. Treves defines the sigmoid as extending to the third sacral vertebra, thus including what is usually described as the first part of the rectum. It lies not in the iliac fossa but partially or completely in the pelvis. It is not usually S-shaped, but a large loop seventeen and a half inches long, more like the Greek Ω (omega), the top of the loop sometimes even touching the right side of the pelvis. (Treves.)

At either end of the sigmoid is a constriction which Cantlié (*Jour. Trop. Med.*, 1915) describes as a sphincter, to which he gives the same importance as to the pylorus. He describes the sigmoid as an organ with a definite function and not a mere channel for the passage of feces. The mucosa of the sigmoid is not so loose as in other portions of the colon.

It is a well-known fact that the sigmoid mesocolon varies much in length, and this leads to varying degrees of mobility, with occasionally a twisting of this upon itself, producing volvulus.

If as Cantlié claims there is sphincteric action at either end of the sigmoid it must be possible for spasm to occur here and thus to impede the flow through the intestine at this point, just as we see cardiospasm and pylorospasm at the stomach.

These anatomical and physiological factors may easily lead to a partial or complete stoppage of the fecal flow through the large bowel, and thus become an important factor in the production of intestinal stasis.

If the bowel twists completely on itself we have produced volvulus with the symptoms of acute intestinal obstruction, but if the sigmoid becomes distended and displaced, with the two extremities attached, as they are, close to the abdominal wall, it is easy to see how the bowel may become bent upon itself, and an angulation instead of a twisting result. This angulation produces a partial obstruction with the symptoms of intestinal stasis.

Angulation at the sigmoid may occur at either the upper or lower attachment. When the bowel becomes distended and coils back into the abdomen, along the descending colon we may have the angulation at the proximal end of the sigmoid; this is rare. It is more common for the distended sigmoid loop to drag downward and to acutely bend the bowel at the recto-sigmoid junction. If there is true sphincteric action in the bowel the irritation of this condition may bring about, in addition, spasm of this band of muscular fibers. Whatever may be the cause it is certain that in many cases angulation does occur and is responsible for chronic intestinal symptoms. Occasionally angulation is the result of external bands which pass across the sigmoid or to contraction following a mesosigmoiditis.

Intestinal stasis as a cause of varying degrees of ill health is a recognized fact. The majority of surgeons are agreed that to overcome this it is not necessary to do the radical operation proposed and practised by Lane. Experience has shown that the fault may be at some particular section of the large bowel and that a correction of this defect produces just as good results, with less mortality, than the operation of complete colectomy.

Resection of the cecum, ascending colon, and a portion of the transverse colon is necessary in some cases; in others the freeing of adhesions at either the hepatic or splenic flexures or the overcoming of a prolapsed transverse colon is necessary, while

in others, as we have already shown (*Ann. Surg.*, November, 1905), the cause is found in a relaxed sigmoid that angulates itself at times and requires resection of that portion of the bowel for relief.

We are convinced by our own experience, as well as that of some of our colleagues, that this condition exists more frequently than is generally recognized. It can always be demonstrated by the *x*-rays.

The symptoms are persistent and obstinate constipation, weight in the pelvis or left iliac region, pain in the back over the sacrum, and occasionally a tumor may be felt in the left iliac region. This is the distended sigmoid, and will often disappear after the use of an enema.

Angulation may be so acute that complete obstruction is produced and then all of the symptoms of intestinal obstruction appear.

The treatment consists in resection of as much of the sigmoid as is necessary to straighten the canal and prevent a recurrence of the condition. In a few of our early cases we produced an anastomosis between the two limbs of the sigmoid, but have been better pleased with the results after resection. The operation is easy of performance and is accompanied by very little shock.

It is well to pass a rectal tube beyond the point of suture before the abdomen is closed and to leave this in place for forty-eight hours. This relieves the patient of gas and prevents any pressure on the line of suture.

We have records of about 40 cases, from which the following will serve as illustrations:

Case I.—Female, aged thirty-six years, patient of Dr. J. J. Masterson, has suffered for many years with intestinal symptoms, flatulence and obstinate constipation, pain in the sacral region and a feeling of fulness in the pelvis. Had been operated before coming under our observation and the appendix removed and the gall-bladder drained, without benefit. X-rays (Fig. 1) showed a redundant sigmoid passing high in the abdomen. Operation

with resection of twelve inches of the sigmoid was followed by a disappearance of the symptoms and relief of the constipation.

FIG. 1.—Case I. Roentgenogram showing redundant sigmoid passing high in the abdomen.

CASE II.—Male, aged sixty-five years, patient of Dr. H. W. Price, was seized with pain in left iliac region, distention, inability to move the bowels for several days, tenderness and a mass in the left side of the abdomen. There was no fever and the patient was able to be about. After the bowels were moved the tumor gradually disappeared and the intestinal symptoms cleared up. X-rays (Fig. 2) showed in this case a similar condition of the sigmoid. The mass, which had been plainly felt by three different examiners, was thought to be a malignant growth of the colon. It has since disappeared and the *x*-ray examination shows no constriction or irregularity of any point of the bowel other than the enlarged sigmoid.

FIG. 2.—Case II. Roentgenogram showing condition similar to Case I.

CASE III.—"Male reported by Dr. R. M. Rome (*Long Island Med. Jour.*, vii, 252), had suffered for fifteen years with chronic intestinal stasis, with marked auto-intoxication and frequent and severe attacks of gout. A year ago (before the report) was operated and a redundant sigmoid found and ten inches resected. He has not had an attack of gout since the operation, no evidence of intoxication and only occasionally has to use a cathartic."

Fig. 3 is an *x*-ray of a child (patient of Dr. Charles Cochrane), showing that the same condition is present early in life.

CASE IV.—Boy, aged six years, had always been markedly constipated and would pass three or four days without an evacuation. The use of an enema would produce a free evacuation, but as this was always followed by a convulsion the mother would delay its use as long as possible. Operation revealed a

general ptosis of the transverse colon and a long-displaced sigmoid. Seven years ago operation was performed so as to relieve the condition at the sigmoid; the center of the prolapsed transverse colon was anastomosed to the lower segment of the sigmoid, thus producing a straight canal. Since then there have been no convulsions and only occasionally are cathartics necessary. He has developed normally and today is perfectly well.

FIG. 3.—Roentgenogram of child, showing redundant sigmoid.

CASE V (Fig. 4).—Woman, aged fifty-five years, patient of Dr. Roger Durham, has had several attacks of constipation lasting for several days, with abdominal pain and at times a mass in the left iliac fossa. Between attacks patient suffers from discomfort and constipation, which latter dated from the primary attack. Two days before admission a sudden sharp

pain occurred in the left iliac region, spreading soon over the entire abdomen. This was dull in character and was succeeded by vomiting when any nourishment was taken. Vomitus was not fecal. All attempts to move her bowels had failed. Examination showed an elderly appearing woman, of fair nourishment, who did not seem critically ill. The abdomen was generally distended, not boardy, and fuller on the left side. A mass

Fig. 4.—Case V.

as large as a child's head could be felt in the left iliac region, tender to touch, and so much so that a careful determination of the nature and limits of the mass was impossible. Attempts to move the bowels by enemata were ineffectual. Under anesthetic the same mass could be felt by the vagina, and seemed to be a distended coil of intestine. During this manipulation a gurgling sound was heard and the mass disappeared, coinci-

dently with a copious evacuation per rectum. The patient was sent back to bed, the bowels were thoroughly emptied and an *x*-ray picture taken of the sigmoid. This revealed an hypertrophied loop of sigmoid about a foot long. This was evidently the cause of the attacks of bowel obstruction, due to the twisting and consequent occlusion of the gut. At the end of a week the patient was operated upon through a left rectus incision, and the loop of sigmoid, about a foot in all, was excised and an end-to-end anastomosis done. A long rectal tube was inserted past the line of anastomosis. The bowels moved on the fourth day, at which time the tube was removed, and several times each day following, without cathartics. There was some wound infection of the superficial layers, and the patient went home at the end of five weeks cured.

Of the cases seen some have been entirely relieved by the use of enemata and general medical treatment. Of those operated, a few have not been completely relieved of all their symptoms, but in most of them constipation has been completely overcome.

DISCUSSION

Dr. Leonard Freeman, Denver, Colorado:

It seems to me that Dr. Delatour's conclusions, although interesting, are perhaps too drastic. I cannot agree with him that operations for the removal of the sigmoid are extremely easy or without danger. I believe that there are a number of cases in which the removal of the sigmoid is not at all necessary for the relief of moderate obstructions and that these cases can be determined at the time of operation. I remember three instances in which I was able to see how the obstruction took place and to suture the sigmoid to the abdominal parietes in such a way that the obstruction could not recur. The subsequent history of the cases has shown that the methods were correct. In another case, in which I resected the sigmoid loop for obstruction, a subsequent stricture took place and the patient is now suffering from the effects of the operation. I believe it is better to use judgment in each case; sometimes resecting the sigmoid and sometimes fastening the sigmoid to the abdominal parietes in such a way as to relieve the obstruction.

Dr. Arthur D. Bevan, Chicago:

As I understand from Dr. Delatour's paper he has operated on 40 of these cases of angulation of the sigmoid and I question very much whether in all these cases or in any of them operation should have been done. Certainly we should demand before we operate on a case of this kind some definite organic lesion outside of the mere angulation that may occur in the large sigmoid. It seems rather strange that Dr. Delatour should see 40 of these cases demanding operation, and a surgeon like myself, for instance, has never seen one. I am not criticising his scientific enthusiasm or his judgment in deciding upon these operations excepting on this stand-point that I have never myself seen a case where I thought a sigmoid should be resected, unless at the time of the operation we could actually find some gross lesion, either a carcinoma or a diverticulitis or a stricture or something that would be absolutely gross and tangible. The sigmoid is a loop that varies tremendously in extent. The length of the sigmoid varies from 12 to 24 inches. A 24-inch sigmoid may be in the *x*-ray a voluminous sight, but it may be absolutely normal and have nothing whatever to do with the symptoms. My own judgment would be that in cases of this kind where we have a condition in the sigmoid to deal with that in the absence of a gross

lesion they should be much better handled by enemas, cathartics and massage and dietetics than by operative interference and I question very much whether in the absence of a gross, definite lesion a resection of the sigmoid is warranted in these cases.

Dr. Howard Lilienthal, New York City:

I would like to ask Dr. Delatour whether it is not possible that some of the cases which he has shown may not have been cases of volvulus?

Dr. Henry B. Delatour, Brooklyn, New York (closing):

Answering Dr. Lilienthal first I would say that I do not think these cases are cases of volvulus. The symptoms are not as acute nor as severe as in volvulus. I may have given a wrong impression in the paper that I had resected 40 cases. I have records of 40 cases, comprising those of my own and some of my colleagues; in some resection was performed, in others suture, as suggested by Dr. Freeman, and in still others only medical means were employed. We have seen many cases in which no operation at all was done in which satisfactory results have followed the use of enemata, etc. In one of the cases reported, that of a gentleman of sixty-five years of age, there has been no operation. In a number of these cases no treatment seemed to give relief, and operation was followed by a subsidence of all previous symptoms.

If we do not believe in the surgery of stasis we will not look for these cases and of course will see none.

CARCINOMA OF THE SPLENIC FLEXURE OF THE COLON

By JOHN A. HARTWELL, M.D.
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The problems presented by 6 cases of carcinoma of the splenic flexure of the colon or its immediate proximity were so difficult of solution that the writer was led to make an extended study of the subject. The lack of success of many others in solving these problems coincide so exactly with his own that it seems proper to ask the attention of the Association to them, in the hope that the discussion may yield some measure of improvement in dealing with them. While there is found some encouragement in the literature, the complete story shows that cancer at the splenic flexure has proved to be a peculiarly fatal lesion. The record of the 6 cases observed is as follows:

Case I.—J. C., male, aged twenty-seven years. Admitted to hospital May 6, 1913, suffering from a well-developed intestinal obstruction of six days' duration. The pain seemed to center in the right lower quadrant. The only cause that could be considered from a study of the history and the abdominal examination was that of constricting bands at the cecum, as a sequela to an interval appendectomy done two years previously. An incision was made over the cecal region. A band passed across the cecum from the omentum outward to the abdominal wall, and the pressure exerted had been so extreme that the entire caput coli had sloughed away. The ileocecal orifice presented. The peritoneum contained several quarts of fluid feces. This was thoroughly washed out and the cecum

drawn into the wound by stitching the free edges to the peritoneum and skin. Recovery was unexpected, but gradually took place. Many weeks had to be spent in getting the patient into condition to deal with the open cecum. When this was undertaken it was discovered that the true cause of the intestinal obstruction was a constricting cancer just distal to the splenic flexure, and the band across the cecum was secondarily responsible for its destruction. A lateral ileosigmoidostomy was done, with an excision of the cecum and the ascending colon, the free ends of the bowel being closed. The patient steadily gained after this operation, and four months later the cancer, with the remaining portion of the colon, was removed. It was noted that the closed end of the sigmoid, proximal to the anastomosis, had developed a well-marked cecal pouch. When last seen, nearly two years later, he was dying of general peritoneal carcinosis.

The study of the tumor showed it to be a mixed scirrhous and colloid carcinoma. The growth completely surrounded the colon and closed its lumen. At one point there was a perforation in the base of an indurated villus-like ulcer, but no abscess had developed.

Case II.—E. B., female, aged thirty-five years. Admitted to hospital July 17, 1913. Twelve years earlier she had had a double oöphorectomy for excessive dysmenorrhea. She remained well for eight years. Then she began to suffer from abdominal pain, of a recurrent type, which seemed to center about the cecum. A diagnosis of chronic appendicitis was made, though a late manifestation of peritoneal adhesions was considered. The attacks were very infrequent and not severe enough to call for operation until a week or two before admission to hospital. From that time, however, they had progressed markedly, and nausea with vomiting was present.

At the time of admission the patient was at the height of an attack and demanded immediate operation, because the pain had grown so severe in the preceding twelve hours. The physical examination gave no further evidence of the seat of the trouble than could be obtained from pain and tenderness over

the cecum. A median laparotomy was done because of the doubtful diagnosis. A slightly inflamed appendix was removed. Exploration revealed a hard, encircling cancer just beyond the splenic flexure. There was no anatomical evidence of complete obstruction. The proximal transverse colon had, however, become adherent to the descending colon, immediately distal to the tumor—nature's attempt to overcome the impending obstruction. The growth, with its adjacent colon, was resected and an end-to-end anastomosis done. This was difficult because of tension on the intestine. Drainage was established through a counter-opening in the flank. Death occurred on the fifth day. Autopsy disclosed an abscess in the omentum which had been placed around the suture line as a barrier. The tumor encircled the colon, embracing all its coats. Within the narrowed bowel was a cauliflower mass which left a lumen of only 3 mm. The microscopic section showed the tumor to be adenocarcinoma. The cauliflower mass classes it with the encephaloid group.

These 2 cases illustrate a condition which is several times described in the literature, in which the symptoms center about the cecum rather than the site of the lesion.

Passot (quoted by Veaudeau) reports a case very similar to the first.

CASE III.—W. B., male, aged forty-seven years. Admitted to hospital December 6, 1916. A history of recurrent diarrhea, extending over many years ("all his life") was obtained. Constipation had never been present. For two years he had suffered from indefinite symptoms described as indigestion. During recent months he had noticed blood and mucus in the stools. (This fact was only learned after operation.) In the fall of 1916 he was under treatment for the gastric symptoms and received gastric lavage. During this procedure, late in November, he was seized with moderately severe pain at the left costal margin. This had recurred intermittently since then. He now refers the pain to a region beneath the lower ribs from the midclavicular line backward nearly to the spine. Gradually the pain

has become a constant dull ache, which is increased on any deep respiratory movement. It is also rendered more severe by a full stomach. Examination on admission showed the patient to be moderately ill. The temperature varied between 98° and 102°. The leukocyte count was 14,000, with 78 per cent. polynuclear cells. There existed all the signs of a left subdiaphragmatic abscess, and the tentative diagnosis of a subacute perforation of a gastric ulcer near the cardia was made.

At operation a curved incision was carried from the mid-axillary line forward, and later enlarged by dividing the rectus muscle. On gaining entrance to the peritoneum a large abscess was encountered containing many ounces of foul-smelling pus. Only after very considerable difficulty in separating the matted omentum from the stomach and the transverse colon in front, the spleen and the kidney posteriorly, and the diaphragm above, was the cause of the condition discovered. A cancer of the splenic flexure, with perforation, was present. The tumor and adjoining colon were mobilized with difficulty, and the entire diseased portion, with a sufficient margin of healthy bowel on either side, brought outside of the abdomen. The Mikulicz procedure was attempted, but could not be accomplished because the proximal and distal portions could not be brought sufficiently in apposition. The required amount of bowel was therefore excised and a tube placed in the open ends, held within a constricting purse-string (Paul's operation). The two ends were then placed in approximation and the afferent and efferent arms sutured. The greater part of the wound was closed, a gauze packing and tube drainage being placed in the bed of the diaphragm to control hemorrhage, which was rather severe.

An error was made in attempting to place the two arms of the gut in apposition. This resulted in too great tension, so that retraction occurred, and the fecal discharge from the proximal end could not be prevented from constantly reinfecting the subdiaphragmatic space. A counter-drainage was resorted to, as the result of which an empyema developed. The original abscess cavity became clean, and a well-functionating artificial

anus was established. A rib resection to control the empyema failed of its purpose, and the patient died from chronic sepsis, six weeks after the first operation.

Examination of the excised lesion showed it to be carcinoma with thick strands of cellular fibrous tissue—the scirrhous type. It involved the entire circumference of the bowel, infiltrating all the coats. A minimal lumen remained. The base of the cancer was ulcerated with overhanging edges. Its longitudinal extent was less than one inch. A perforation about one-third inch in diameter was present. A lymph node found in the mesentery of the excised bowel showed no carcinoma.

In view of the complicating abscess and the impossibility of properly protecting it from fecal drainage, a better plan than the one followed could have been devised. A cecostomy, with large siphon drainage, and the eventration of the involved colon, with closure of the peritoneum around it for later resection, would have given opportunity to deal with the abscess cavity. The reëstablishment of the colonic tract could then have been dealt with at leisure.

An example (Schwab's case) of perforation of a similar tumor, with subdiaphragmatic abscess is reported by Madelung. Hutchinson and Wolback report a similar case. (See case reports.)

Case IV.—L. F., female, aged forty-two years. Admitted to hospital April 8, 1916. For two years she had suffered from pyrosis, which was relieved by sodium bicarbonate. For one month pain in the left abdomen and lumbar regions had been present. It was of a dull, aching character. No history of any disturbance of the bowels or blood in the stools could be obtained. A complete intestinal obstruction had developed five days prior to admission. There was nothing found on physical examination to determine the cause of the obstruction because the marked abdominal distention obscured all else. Through a median suprapubic incision it was found to lie in an annular constriction at the splenic flexure. The cecum was distended to the bursting-point. The median wound was closed and a cecos-

tomy performed, with tube drainage through an intermuscular appendix incision. Recovery was satisfactory, the cecostomy functionating well. The radical removal of the tumor was done nineteen days later. Through a transverse incision the tumor, which lay two or three inches below the apex of the flexure, was thoroughly mobilized in the usual way, and the bowel from the sigmoid to above the flexure resected, Payr clamps and the cautery being used. The ends were closed by chromic gut ligation immediately behind the clamps, and the ligated ends inverted inside a double row of linen sutures, the first as a purse-string and the second an over-and-over Lembert suture. A lateral anastomosis was then done between the transverse colon and the sigmoid, the usual type of chromic and linen suture being employed. The abdominal wound was closed to its outer portion, where the bowel ends and the anastomosis could be placed practically extraperitoneally. Drains were placed so as to avoid contact with the suture lines in the intestines. In order to obtain sufficient mobilization it was necessary to place the stoma in the transverse colon, about five inches proximal to the flexure, thus leaving a blind pouch of this length distal to the anastomotic opening. The cecostomy was not disturbed, it being desired to have this as an outlet in case of any tendency to overdistention. For one week the convalescence was perfectly smooth. The cecostomy functionated and there was no distention. On that day there appeared a slight fecal discharge from the drainage wound, but the peritoneum did not seem infected. The following day, however, the patient showed signs of sudden collapse, began to vomit persistently, without distention or other evidence of peritonitis, and died in a few hours, in spite of gastric lavage and other attempted remedies. No autopsy was obtained. The actual cause of death remains in doubt because there was absence of signs of peritonitis or local abscess, and in some points the symptoms suggested a pulmonary embolism. For the reasons discussed in operative technic a greater length of colon should have been resected. The tumor proved to be an annular growth one inch and a half in longi-

tudinal extent. It caused a nearly complete obstruction of the lumen. Microscopically, the growth was of the infiltrating type, all the walls being involved, and it corresponded more nearly to the scirrhous type than to the colloid or to the encephaloid.

CASE V.—F. S., male, aged fifty years. Admitted June 27, 1916. The history showed that there had been well-marked evidence of the true condition for fully two years. There existed a disturbed condition of the bowels, with diarrhea and constipation. On several occasions blood had appeared in the stools. For six months he had suffered from very evident attacks of partial obstruction, followed by periods of diarrhea. These had progressively grown more severe and frequent. On admission he was suffering a complete obstruction of at least three days' duration. Abdominal examination showed the colon as far as the splenic flexure enormously dilated and not apparently so beyond this. The patient was a marked alcoholic and suffered from advanced myocardial and kidney lesions, so that any extended operation was impossible.

A cecostomy was performed and functionated satisfactorily. July 20 his condition was sufficiently good to justify an attempt at an anastomosis around the obstruction, which could now be palpated as a large fixed tumor at the splenic flexure. Through a median incision a lateral anastomosis, without exclusion, was done between the lower ileum and the descending colon. Examination of the tumor showed it to be a large nodular neoplasm involving the entire splenic flexure and adherent to the posterior parieties. Hard, enlarged lymph nodes were palpable in the mesentery. Its excision was impracticable because of the technical difficulties and the very poor operative risk presented by the patient.

The fecal current gradually found its way through the anastomotic stoma and the cecostomy closed in about a month. The further course was satisfactory until on a very hot day he overworked and indulged in excessive eating. This resulted in an acute attack of vomiting and a marked retention of fecal matter in the ascending and transverse colon. This was relieved by

opening the cecostomy and inserting a tube. He gradually recovered and there was only moderate discharge from the artificial opening. The same condition recurred, however. In spite of free drainage through the cecostomy he rapidly lost strength and died about ten weeks after the original operation.

No autopsy was obtained. The diagnosis is not, therefore, microscopically confirmed, but operative palpation and inspection presented all the characteristics of carcinoma.

Case VI.—Only clinical evidence exists for the diagnosis of carcinoma in this case. The patient is a woman, aged seventy-six years, who was first seen January 17, 1917, with a well-developed and practically complete attack of intestinal obstruction. The pain was very severe and was localized by the patient in the left hypochondrium. A history was obtained showing that there had been two or three previous attacks of a similar nature during the preceding six months. They had been progressive in severity and frequency. The last one, about five weeks earlier, had been nearly complete. It had been accompanied by the passage of blood in the stool. Her physician diagnosed cancer of the colon at that time. By the use of morphin, turpentine stupes, repeated enemata, and colon irrigations the condition was again relieved at the end of one week. The patient still (Aug. 25, 1917) remains in comparative health, and by the free use of mineral oil, colon irrigations, and great care in diet has been able to avoid any further attack. Her age and general condition precludes urging operation, to which her family is strongly opposed. The abdomen is now relaxed and a hard, non-movable tumor is palpable in the region of the splenic flexure. There can be little doubt of the diagnosis in this case. A chronic inflammatory lesion, such as a diverticulitis, is a possibility, but the freedom from pain when obstruction is not present is opposed to this, as is the occurrence of obstruction without evidence of an abscess. (Cf. Castaigne's case p. 49.)

These 6 cases illustrate in every phase the characteristics of the cases found in the literature. Their further discussion may therefore be postponed until a review of other reports has been

presented. For the earlier reports we shall draw largely on Madelung's paper, in 1906, which includes 93 cases from the literature and 7 of his own.

Histologically, cancer of the splenic flexure differs in no way from cancer in other parts of the large intestine. The growth in all cases originates in the mucosa, probably from the cells in the crypts, and it is governed by the same unknown factors which obtain elsewhere. Paul's classification into the scirrhous, the colloid, and the encephaloid offers a good descriptive basis; but it must be remembered that these terms are applicable to differences in appearance rather than in essential characteristics. Undoubtedly there exist determining factors which, did we but comprehend them, would help us in explaining why a malignant neoplasm arising from a constant source shows such marked variation in its growth. The variations are those found in cancer generally, and therefore cannot be ascribed to any influence exerted by the location in an infectious area. One exception may exist to this generalization. These colonic growths are prone to ulceration and perforation. The bacterial action of the intestinal content may conceivably have some bearing on this complication. The three varieties are not clear-cut, and often the same growth shows characteristics of more than one type, as illustrated in Case I, here reported, where a hard annular scirrhous tumor showed colloid degeneration, and a central perforation, and Case III where the scirrhous and encephaloid were combined.

Paul's statement that the encephaloid is the most common and the least malignant is borne out by other reporters, though unfortunately little pathological detail is given in most cases. This type grows more bulkily into the lumen of the intestine and has less infiltrating power than the other types. It approaches more nearly, or differs less, from the benign polypo-adenoma than the others. Enlarged lymph nodes are usually present in the mesentery, but they are often not invaded by cancer, being simply hyperplastic from infective irritation. The colloid type stands at the head of the list, so far as malignancy is concerned, but fortunately is the least frequent. It tends to local ulcera-

tion, inside of a hard-edged circumscribed growth. The scirrhous type, according to Paul's experience, stands midway between the other two, both in frequency and malignancy. The growth is slow and local. It is characterized by marked fibrosis. The lymph nodes contain cancer elements. Recurrence following removal may occur at a comparatively late period.

Madelung, in his earlier analysis, arrived at the same conclusions as Paul. He, in addition, called attention to the comparative infrequency of distant metastasis. He found the liver involved only six times in 100 cases. In four instances a second growth was found in other parts of the alimentary canal, two of which, however, seemed to be independent growths, rather than metastases. In general, the reported cases confirm the comparative infrequency of distant metastases.

Huguier and Rigollot-Simonnot report a most interesting case in which cancer occurred in the left lobe of the liver. The symptoms were those of an acute abscess with high temperature and leukocyte count. Operation disclosed a cavity in the liver, a fragment of which showed carcinoma of intestinal origin. Only at autopsy was the primary growth found to be in the splenic flexure. From the description the liver involvement was more a direct extension than a true metastasis.

Butlin (quoted by Madelung) finds that over 60 per cent. of patients suffering from colonic cancer die from obstruction or other complications before a serious metastasis occurs. While no extended statistics are at hand for cancer localized to the splenic flexure, this figure is probably low rather than high for this part of the colon.

Böckel and Swain (quoted by Madelung) report the successful removal of splenic flexure cancers in which cancerous nodes were removed. They believed that involved nodes remained, and yet the patients recovered and continued well over long periods.

Madelung, after a complete survey of the evidence, concludes that lymphatic involvement from splenic flexure cancer is not as frequent as from cancer of the cecum and ascending colon.

In our study we are confronted with the same difficulty that he encountered in the study of case reports. Often it is stated that enlarged nodes were present, but no microscopic report is included. The accurate location of the nodes is rarely given. Our conclusion coincides with that of Madelung, but we can give no figures to support it. One is justified in the belief that lymphatic and distant metastases are not a serious menace to successful treatment.

From the aspect of therapy the pathological characteristics of these growths present points both favorable and unfavorable. Their rate of growth is not rapid. Therefore their complete removal should be possible. This is more to be hoped for because of the slight tendency to lymphatic and distant metastasis. But since the lesion is primarily a mucosal manifestation, the early growth is not accompanied by any serious disturbance of function, and pain is not a symptom. Considering the ulcerative character of the lesion, hemorrhage from the bowel should be expected. On the contrary, this is a comparatively rare occurrence. No statistical evidence can be adduced because the records are too incomplete, but absence of mention may be taken as negative evidence. It was present in 3 of our cases. Madelung mentions it in 10 of 100 reported cases. Its absence is certainly of no negative value, and its presence is easily overlooked, or, unfortunately, assigned to other causes. While the localized nature of the lesion favors its removal, the anatomical relations of the splenic flexure present difficulties not found in other portions of the colon. These difficulties are further enhanced by reason of the fact that very often, as just explained, an early diagnosis is not made because the symptoms are not marked. It is only reached when some secondary condition has arisen, such as serious adhesions, obstruction, or abscess formation, any one of which adds enormously to the gravity of the problem confronting the surgeon. These factors will be more fully discussed later.

The splenic flexure is apparently the third most common site of colonic cancer (exclusive of the rectum), the sigmoid loop and

the cecum being the sites of preference. The ascending, the transverse, and the descending colon proper, are comparatively immune. It is a matter of interest to note that the hepatic flexure is not as frequently attacked as the splenic flexure.

Madelung quotes the following autopsy statistics: Bloch reports 4 cases of splenic flexure carcinoma among 138 cases of colonic cancer. Lambret, 8 cases among 237. De Bovis, 21 cases among 426. A total of 33 cases of cancer of the splenic flexure in a series of 801 cases of cancer of the colon in general, exclusive of the rectum, *i. e.*, 4+ per cent.

The ratio of cases reported from clinical records by surgeons is essentially different. Madelung quotes the following: Clogg, 6 cancers of splenic flexure in 25 cases of colonic cancer. Dollinger 1 in 25, Hartmann 1 in 10, Hochenegg 2 in 7. Körte 7 in 54, Mikulicz 12 in 86, Rotter 2 in 34; a total of 31 cancers of the splenic flexure in 241 colonic cancers, 12.8 per cent.

William J. Mayo, in the presentation of "The Surgery of the Large Intestine" before this Association in 1909 reported 61 cases of cancer of the colon, 7 of which were found in the transverse colon and its two flexures, but the exact distribution of these is not given. Cope reports finding 3 cases of splenic flexure cancer among 20 cases in the entire colon. Corner found the splenic flexure involved in 2 per cent. of the cases of colonic cancer occurring in St. Thomas's Hospital in 1910 and 1911. Veaudeau mentions 1 case in 7. Mumford found 16 cases among 48 in the Massachusetts General Hospital records covering sixteen years. Rotter reports 8 cases in a study of 49 cases of colonic cancer.

It will be noted that the various autopsy reports run fairly constant, the extremes being 3.3 per cent. and 4.9 per cent., while the clinical reports show a wide variation from 4 per cent. to a fraction less than 30 per cent. Undoubtedly the autopsy records are the more nearly correct, both because they include a greater number of cases, and because they are based on final observations and are not limited by the many factors which influence the cases coming to operation.

A search of the American, English, French and German literature since Madelung's report of 100 clinical cases in 1906, shows 57 to have been reported. Probably others are included in the general subject of colonic cancer and intestinal obstruction, but cannot be identified. Only 4 appear in the records of the New York Surgical Society (2 more being mentioned but not recorded) during the last ten years, and none in those of the Philadelphia Academy of Surgery, as published in the *Annals of Surgery*. From these figures it is apparent that the condition is not a common one, and that even the surgeon of large experience can see only a comparatively small number. The rather discouraging results obtained may, to a certain extent, be due to the fact that a definite technic has not been worked out. The mode of attack differs markedly, and the successes do not seem to be entirely dependent upon any one procedure. Certain factors in the successes, however, stand out rather forcibly, which we shall discuss in detail later. Veaudeau truly says that the statistics are very unsatisfactory, and a conclusion can be more accurately drawn from general impressions than from an array of figures.

From a study of the symptoms, it is apparent that in many instances symptoms are present over a long period which should lead to an early diagnosis. On the other hand, diagnosis is delayed in fully one-half of the cases until a serious acute complication is added to the original lesion. In part this is the result of lack of intelligence on the part of the patient, and a less excusable lack of education on the part of the medical profession. In part, however, it arises from the fact already mentioned, that these growths may occasion surprisingly little disturbance prior to the onset of the complicating lesion. If of the scirrhous type, they grow as a mildly ulcerating annular extension around the bowel. The contraction of the fibrosis tends to a narrowing of the lumen. Bleeding is not a marked manifestation, and is not sufficient to attract attention in the stool. As is well known, the intestine itself is not especially susceptible to pain giving stimuli unless the peritoneal coat is dragged upon. This coat

is involved only as a late manifestation and in many cases remains almost intact unless a perforation takes place. Pain, therefore, from the presence of the growth itself, does not occur, and is only instituted when a complicating lesion arises. All these factors are also present in the colloid type, and hence its early manifestation is obscure. In the encephaloid type the growth is less annular and more a heaped up mass of ulcerating carcinoma. Such evidence as the very meager reports show seems to indicate that this type is more prone to bleed than the others, but even here the amount is rarely excessive. In the 6 cases here reported hemorrhage was present in 3, and while the specimen was removed in only 1 of these, to prove it belonged to the encephaloid group, the evidence obtained by the massive character of the others probably so places them. The question of progressive obstruction still remains to be considered as a factor in making an early diagnosis. This should be most apparent in the scirrhous and colloid groups, because of the tendency to a contracting fibrosis. The colonic content at the splenic flexure is still fluid, hence a very considerable constriction may take place before the fecal current is stopped. It may be retarded, but this gives rise to no localizing symptoms. It seeps through into the lower colon, the water is there absorbed, and the rectosigmoid reservoir produces a normal formed stool. It is thus explained that the pencil stool, so graphically described as a symptom, does not occur. In fact, this is absent even in constriction much lower down, sometimes within reach of the palpating finger per anum. Experimental evidence and clinical observation both emphasize the fact that the symptoms of intestinal obstruction do not arise until the closure of the constriction stops the passage of gas. Numerous specimens show a constriction only allowing the passage of a probe, which, however, had never produced obstruction until suddenly a complete acute occlusion supervened. Case II, here reported, illustrates the absence of obstruction with a lumen of one-eighth inch. Case IV showed a "minimal" lumen, but never had had symptoms previous to her admission with complete

intestinal obstruction. Many patients trained to careful observation under the care of competent men, are totally unaware that they are seriously ill until a sudden obstruction arises. The authors studied place the proportion of cases of cancer of the colon presenting a complete obstruction as the first really diagnostic symptom at from 40 per cent. to 60 per cent. For the splenic flexure this is probably low rather than high (*vide infra*). There is, however, one symptom which careful questioning may elicit in a minority of cases. The patient says true constipation is not present, but that even after what seems a normal evacuation of the bowel there exists the desire for a further movement. The probable explanation of this is found in the fact that the colon above the stricture is a constantly filled reservoir, which continually feeds fecal matter into the lower bowel, so that the latter never has the normal rest to which it is entitled. It is rather surprising that colicky pains are not a more constant symptom. They are mentioned as being present in a goodly proportion of the cases, but often are not severe enough to be considered as significant. Cases II and III illustrate this. If one examine the colon proximal to a constricting cancer, it is always hypertrophied, and sometimes dilated. This permits it to continually force its content through the constriction without undue peristalsis, and so long as it can avoid overdistention from gaseous content there is no painful contraction present.

In 19 cases Madelung found a palpable tumor. In 2 of our cases this was true. While this does not make the diagnosis certain, it makes operation imperative when the exact condition will be disclosed.

It is thus manifest that cancer at the splenic flexure may progress to an advanced stage without the development of any symptoms which could reasonably give rise to a suspicion of the serious lesion harbored. We may, in such cases, exonerate both the patient and the medical profession from the blame attached to a delayed diagnosis. On the other hand, tell-tale symptoms *may* be present in a varying degree, and with careful

study, ought to lead to the suspicion that cancer in or near the splenic flexure is present.

In the 5 operated cases here reported, only 1 came to operative treatment prior to an acute complicating lesion which immediately threatened death. Even in this one (Case II) complete intestinal obstruction was forestalled only by a few hours. A study of the histories given, however, demonstrates that the data for a tentative diagnosis were present in 3 of the cases many weeks or months prior to the acute onset. The conclusion is inevitable that the importance of minor disturbances is not fully appreciated, and that the same campaign of education must be undertaken as is being done in the case of mammary cancer, uterine cancer, stomach cancer, etc.

Undoubtedly the most common complication which supervenes to attract attention is intestinal obstruction of varying degree.

As previously pointed out, this is often absent until the lumen of the colon is closed to an astonishing degree. On the other hand, it may come about because of impaction, either of feces or a foreign body, because of inflammatory swelling as the result of ulceration, or because of adhesions and kinking. These various conditions are probably responsible for those cases which show repeated attacks of almost complete obstruction, followed by a comparative recovery. Cases V and VI in our report are illustrations. Many patients are seen who have suffered such attacks over many months. Then an attack more resistant to treatment than the previous ones develops. The condition is then needlessly serious. A patient so suffering demands the most complete study, and failing a diagnosis, exploratory operation should not be postponed beyond the second attack. This teaching is sound, but is wofully neglected. Attack after attack is tided over by various measures. The final one is treated along the old lines with the deluded hope that once successful always successful, and failure only acknowledged when death is imminent. It is not a matter of wonder that under such conditions operative results are discouraging. The question really concerns

that of exploratory operation, and is not as simple as the facts cited would indicate. Between the cases presenting almost no symptoms until an acute obstruction is at hand, and those showing the marked symptoms just discussed, there is a group in which symptoms are present, but in no way urgent. They frequently occur after manifest errors in diet, or when the digestion is disturbed by overfatigue and anxiety. They are indefinite, and vary considerably in their character. They in nowise differ from disturbances which have no gross lesion as their basis. The most careful examination by every method of diagnostic aid fails to do more than arouse a suspicion of a serious condition. To advise every patient under such circumstances to submit to an exploratory operation with its attendant risk, suffering, financial burden and other disadvantages, is a satisfactory and sure method of learning the truth, but it is a severe method if the true condition be nothing calling for or helped by operation. This picture of the exploratory operation is not overdrawn if the patient be the draughtsman. The risk is known by the surgeon to be minimal, the suffering often lasts only through the nausea induced by the anesthetic, the financial burden can be fully controlled, and the anxiety can be dispelled by a tactful optimist. The fact remains, however, that an exploratory operation with negative findings is a serious undertaking, and one that the conscientious surgeon is loathe to have part in. What, then, is the proper course in these cases of suspicious, but not positive symptoms? It is to be found in a much more thorough study than is usually given. In private practice the patient must be taken into one's confidence, and made to carefully study his own symptoms, without being alarmed. He must, on one pretext or another, be seen at intervals, even though in apparent health. A careful analysis of the symptoms must be tabulated. Do they persist after palpable errors in hygiene have been corrected? Is there a tendency for them to become gradually more insistent? Cannot some positive evidence, such as melena, a definite subcostal pain or tenderness, or the radiographic plate be made to give the needed clue which justifies

insistence on an exploration? In hospital practice we can more completely control the patient while he is actually in the ward, and as a rule can carry out all needed study. Failing, however, of any positive findings, we have more difficulty in keeping him under observation over an extended period. The development of the social service bureau, the follow-up system, and a closer affiliation between the wards and the out-patient rooms, is improving our opportunities in this direction, and except in the most unintelligent and roving classes we are able to keep in touch with our cases. Our justification for so fully discussing this phase of the subject lies in the fact that a large proportion of our failures in dealing with cancer of the splenic flexure is directly and solely assignable to the acute or subacute complication occurring before operation is undertaken. A greater measure of primary success can only come if we devise some means to do our surgery earlier. Even with the greatest care exploration must always have a valuable place.

The problem of the surgical interference in cancer of the splenic flexure presents certain distinct difficulties which do not exist in other parts of the colon. Surgically, it is inaccessible. If surrounded by an inflammatory zone, it becomes densely adherent to the stomach, near the cardia, the diaphragm, the kidney, the spleen or the pancreas. Case reports show that all of these may coexist. The colon at the flexure, and distal to it, is provided with no mesentery. A goodly portion of its circumference therefore has no serous covering. The immediately adjoining segments, on both the proximal and distal sides, are not mobile, so that approximation is difficult. The failures reported may, many of them, be explained because these difficulties were not overcome. (Compare Cases II and III.) Success lies in devising a technic which will overcome them, and to this end a study of all the case reports collected has been made. Including Madelung's, there are 157 cases. Many of these fail to give sufficient operative detail to be of value, so that our study is based upon an analysis of 128 cases. As a conclusion of his studies Madelung sums up: An enteros-

tomy (mostly a cecostomy) was done 26 times, 24 times for complete obstruction. In only 2 cases was life appreciably lengthened. Entero-enterostomy was done 12 times, 6 times in the presence of complete obstruction. One-half died immediately following operation. Of the other 6, the greatest postoperative length of life reported was one year, though 2 were still living two years and three months after the operation, at the time of the report. Enterostomy and entero-enterostomy was done 11 times, 8 times in the presence of complete obstruction. Life was prolonged in 8 of these, 1 living for three years and four months after operation, and 1 being in good health one year and three months after operation, at the time of the report. The other 6 lived for three and a half to fourteen months.

Resection was done 34 times; 14 times after enterostomy and once after enterostomy and entero-enterostomy. In the 34 cases complete obstruction existed 18 times. Twenty cases survived the operation, in 9 of whom complete obstruction was present. In 6 cases the length of life after operation is not given. Fourteen lived from seven months to two years or more. Six remained well for more than three years; that is, a possible permanent cure was obtained in only 8.4 per cent. of all the cases in which operative relief was attempted. These 6 were as follows:

Bilton-Pollard.—Colloid carcinoma, size of fist. No lymph nodes present. Male, aged twenty-nine years. Flatulence for four years. Colicky pain with constipation for one and a half years and melena. Resection April 8, 1901, including tumor and only two inches healthy bowel on either side. End-to-end anastomosis. In "perfect health" when reported, December 3, 1904 ($3\frac{1}{2}$ years).

Hochenegg.—Male, aged forty-one years. Small annular cancer. Freely mobilized and brought outside wound. Surrounded with iodoform tampon. Proximal enterostomy. Resection and suture. (End-to-end or lateral not stated.) In perfect health five years later.

Bilton-Pollard.—Female, aged fifty-five years. A mass, including the cancer of the flexure, and involving the left kidney, and

the tail of the pancreas was mobilized and brought out through an oblique incision. Excision of fourteen inches of colon, and end-to-end anastomosis with the Murphy button. Obstruction occurred and was relieved by colostomy and removal of the button five days later. Slow convalescence. Good health five years and three months later.

Böckel.—Female, aged forty-three years. Annular cancer with lymphatic involvement. Twenty centimeters colon resected with end-to-end anastomosis. Fecal fistula for short time. Good health five years later.

Sasse.—Female, aged thirty-six years. Extensively adherent carcinoma. Resection from middle of transverse colon to beginning of sigmoid. Direct suturing end to end. Spontaneous closure of fecal fistula. In good health after seven and a half years.

Kosinski.—Female. Good health eight years after resection.

The following abstract of cases since Madelung's report present points of interest bearing on the diagnosis and the outcome of operative interference.

Denk (three cases).—I. (Case 20), 1906.—Male, aged seventy-one years. Cancer of splenic flexure and gastrocolic fistula. Two-stage operation. Death from peritonitis and pneumonia. This patient had had stomach crises for ten years. For one year past emaciation, anorexia, constipation. For five months putrid belching, increasing prostration. For two months fecal vomiting and diarrhea. Abdomen soft, tenderness over left costal arch. No tumor felt. Operation. Tumor at splenic angle adherent to and perforating the stomach and adherent to the diaphragm. Mass shelled out and defect covered with peritoneum. Resection of part of gastric wall. Colon brought forward. Mikulicz tamponade. Next day tumor removed. Adenocarcinoma. Patient lived three days.

II. (Case 26), 1908.—Male, aged thirty years. Cancer of splenic flexure with ileus. Splashing and rumbling for eight months. Belching, vomiting, obstinate constipation. Occasional blood in stool. For four months rigidity of bowels (?).

High degree of meteorism. Distinct peristalsis. No tumor felt. Operation. Growth size child's fist at splenic flexure. Opening (colostomy) at hepatic flexure. Tumor brought forward and two days later extirpated. By reason of gangrene no histological examination could be made. One month later von Frisch apparatus was placed in the colostomy opening and functionated well. Bowels also moved naturally. Two months later the enterotribe was used and in another six weeks the fecal fistula was closed with semicircular suture.

III. (Case 36), 1907.—Male, aged forty-seven years. Chronic ileus. For two months past violent crises of colic and vomiting. Obstinate constipation. Marked emaciation. Abdomen inflated. No tumor felt. Intestines rigid (?). Operation. Splenic flexure almost closed by cancer. Brought forward with rubber drain in proximal segment. In three days tumor removed. Three weeks later enterotribe used. In two months fistula closed with semicircular suture.

Clogg.—Brief mention of 10 cases of cancer of the splenic flexure. Two were presumably operable and were operated on radically. In 1 case operation was successful; in the other death was due to postoperative adhesions. Of 8 inoperable cases, in 1 there were secondary tumors in the liver; 1 was secondary to a growth in the ovary; 4 were hopelessly adherent; 1 ended in perforative peritonitis and 1 was associated with localized abscess. Elsewhere he states that his 2 operations for cancer of the splenic flexure were followed by death in four months and nine months respectively.

Barker.—Male, aged sixty-two years. Admitted to the hospital for complete intestinal obstruction. Immediate artificial anus established in the lower part of the ileum. Second operation six weeks later—postponed on account of ulceration at the ileostomy wound—ileosigmoidostomy (proximal to ileostomy). Third operation one week later—extirpation of cancer of splenic flexure—both ends of divided colon were closed. Fourth operation twelve weeks later, excision of artificial anus, and closure of the proximal portion of the ileum. Distal end sutured to skin

as safety-valve for the closed cecum and colon. Five years later the patient had gained several stone in weight. The "safety-valve" had, until recently, freely discharged fluid with fecal taint, but is now drying up. A little mucus and gas continue to escape.

Hutchinson and Wolback. Female, aged sixty years. Had complained of abdominal pain for about six months. Generalized but worse in upper half. Constipated for about the same length of time. The pain, slight and colicky, was almost continuous. Thin, anemic, with fairly prominent abdomen, tense and tympanitic, no mass felt, no intestinal movements of ileus.

On admission to the hospital the bowels had not moved for a week. Prompt relief from enema. In a few days return of colicky pain. Exploratory incision. Remains of extensive peritonitis as shown by many adhesions. No sign of colonic obstruction (a band compressed the small intestine somewhat). Suspicion of growth within the colon. Adhesions prevented an anastomosis. The small intestine was freed as a first stage. Against orders she ate solids and died of acute recurrence before she could be operated upon. Autopsy revealed a cancerous ulcer exactly at the splenic flexure with a secondary abscess lying between the colon, kidney and spleen.

Brewer.—Male, aged forty-seven years. Received in the Roosevelt Hospital for acute intestinal obstruction. History of numerous crises of abdominal pain for the past nine or ten months, which had always yielded to catharsis and dieting. Two days before admission a crisis of pain, not relieved by catharsis. Vomiting had set in with increased pain. Abdomen tender and moderately distended. Enemata failed. No stool or gas for twenty-four years. Abdomen opened through median incision without diagnosis. Small intestine and colon up to splenic flexure much distended, sigmoid collapsed. Palpation revealed tumor at splenic flexure. Cecostomy done. Two weeks later second operation. Colostomy sealed up and long incision made over descending colon. Three inches of bowel involved just below flexure. Transverse colon clamped and divided two

inches above mass. Descending colon mobilized, isolated, clamped and divided just above junction with sigmoid. Intervening gut removed, with large share of mesocolon. Both open ends closed and turned in. Lateral anastomosis between transverse colon and sigmoid. Good operative recovery. On the fifth day natural movement. Colostomy wound gradually closed. Discharged in good condition. Diagnosis: Adenocarcinoma. In discussion Woolsey mentioned 2 cases of cancer of the splenic flexure in which there were no premonitory symptoms up to the time of obstruction. In one patient obstruction was absolute. Resection performed. The second patient had been in a state of obstruction for four days before visiting the hospital. An artificial anus was established.

Westbrook.—The cancer was situated a few inches below the left angle. Female, aged forty-seven. Abdominal pain for months. Six months before consultation had submitted to abdominal hysterectomy. Pain continued, thought to be due to adhesions from operation. An acute obstruction developed. Median incision, many adhesions but no constricting bands. Annular carcinoma found as above stated. Five inches of bowel resected, ends brought out and sutured as double barrel. Paul's tubes inserted. Lateral anastomosis and closure of fecal fistula later. No recurrence in four years.

Syms.—Adenocarcinoma of splenic flexure of colon in a woman aged seventy years. Annular, causing almost complete obstruction. Emergency operation. Cancer appeared rather as a constriction than as a tumor. On account of the patient's precarious condition, only a short circuiting operation was done, the transverse to descending colon. The palliative operation apparently stopped the growth of the cancer. Was in perfect health four years later. She then died suddenly from perforation of bowel above anastomosis, after two days of pain and constipation. It was found that the disease had made no appreciable progress. Diagnosis was confirmed by microscope after autopsy.

Delbet.—Female, aged thirty years. Complete occlusion for five days. Cecum and ascending colon distended, sigmoid

empty. Delbet was unable to find the obstruction and extended the incision to the two flexures when it was located at left flexure. Incision over splenic flexure immediately below the ribs, the median incision being closed. Operation in two stages. Tumor exteriorized (it was but slightly movable). A U-thread was made to pass twice through the lips of the incision and the mesentery. Patient rallied notably after establishment of the artificial anus. Ten days later the tumor was ablated. Two months later the colon was mobilized and the two ends united with a double circular suture.

Morison.—Male, aged sixty-two years, was admitted to the hospital for acute obstruction, following a long period of chronic obstruction. Cecostomy February 16, 1909. On March 13 removed a growth at splenic flexure with half of transverse and descending colon, with anastomosis between transverse and iliac colon. March 27, cecostomy closed. No local recurrence in four years. (Later had cancer of cheek and neck lymphatics, also successfully operated upon.) Colon cancer of the usual columnar cell type.

Rotter (eight cases).—I (Case X).—Male, aged fifty-seven years. Six weeks before consultation had colicky pains, worse on left side. Meteorism and severe intestinal hemorrhage. After a brief remission the symptoms returned. Moderate degree of meteorism. A large, firm tumor felt below the left costal arch, extending upward beneath the ribs. There appears to have been no preoperative diagnosis other than ileus. Laparotomy. Cancer of the left colonic angle, adherent to posterior abdominal wall, mesentery of small intestine and stomach. Growth also penetrated into the kidney, to which it adhered. Attempts to loosen adhesions were abandoned. Artificial anus in transverse colon. Marginal necrosis of the edges of the conducting segment of bowel. Operative recovery. Discharged improved.

II (Case XIV).—Male, aged fifty-nine years. For several months before consultation, tendency to constipation. For three days complete obstruction. Marked meteorism. Operation. Left-sided pararectal incision. Very large tumor at left

angle of colon. While endeavoring to mobilize this a fetid, fecal abscess was ruptured. Artificial anus in left side of transverse colon. Death ten days later. Autopsy. Diffuse peritonitis. Metastases in the liver. Thrombosis of left iliac vein.

III (Case XVIII).—Male, aged fifty-four years. Intestinal disturbances for two years; colicky pains at intervals for six months. Intervals progressively shorter, crises more severe. Abdomen moderately distended and tender to pressure. After purgation abdomen softer. Induced splashing sounds in small intestine. First operation. Cecal fistula. Palpation showed tumor in left angle of colon. Second operation one month later. Mobilization and resection of portion of the pancreas, spleen, and stomach. Difficult detachment from kidney. Radical operation abandoned. Death from collapse in thirty-six hours.

IV (Case XXII).—Male, aged thirty-nine years. For months temporary attacks of colic across the abdomen. Relief from purgation. In past few weeks attacks frequent and severe. Two days before consultation fecal vomiting, notable meteorism, no stool, no flatus. When first seen was in collapse. Abdomen very tender to palpation. Operation. Right-sided pararectal incision. Carcinoma 8 cm. long in left angle of colon. Transverse incision to left. Tumor mobilized, extirpated. Artificial anus. Death from collapse in ten hours.

V (Case XXIII).—Female, aged fifty-eight years. For some months abdominal pains, not colicky. Irregular stools. On examination no meteorism. Smooth, movable tumor to left of navel, suggesting a floating kidney. Operation. Left transverse incision. Cancer at left angle of colon adherent to root of mesentery of small intestine, hence inoperable. Ileosigmoid anastomosis. Death in five days from asthenia. No peritonitis.

VI (Case XXXIII).—Female, aged thirty-eight years. Uncomfortable for fourteen days. Meteorism. Stool only after strong laxatives. On inspection marked meteorism. Diagnosis of chronic ileus and cancer of left angle of colon. First operation, fistula ceci. A tumor the size of a walnut could be felt in the

flexure. Second operation (interval not stated), lumbar transverse incision. Tumor exactly in the angle. Transverse colon thick as an arm, inflated, filled with hard stools, prolapsed. Detachment from spleen and stomach. The tumor and transverse colon resected together. End-to-end anastomosis of right transverse to descending colon. Three planes of circular sutures. Sutures covered with omentum. Extraperitoneal cigarette drain. Complete operative recovery.

VII (Case XLV).—Male. Chronic ileus. First operation, left-sided oblique incision. Transverse colon greatly distended; prolapsed. Tumor in left angle. Bowel loosened. A "double" anus established. Second operation. In crushing the septum the result was incomplete. A spur remained, and when this was split infection resulted, with death from peritonitis in four days.

VIII (Case XLIX).—Male, aged forty-three years. Notes of case lost. Cancer of left angle. Ileosigmoidostomy. Resection from middle of transverse colon to descending colon. Both free ends closed and ileum divided. The lower segment was sutured into wound while the upper one was united end to side with the sigmoid. Recovery. All these patients were in bad physical condition.

Renon (four cases).—Case I. Female, aged sixty years. Received in hospital for intestinal occlusion of twelve days' standing. She was in very bad condition. The occlusion had been preceded by several months of constipation. Cecal fistula established. Second stage seven weeks later. Median laparotomy. Recognition of cancer at the splenic angle. It was extirpated and an ileosigmoid lateral anastomosis made with splenic anus. One year later the lower extremity of the splenic anus was doing most of the excretion. An attempt was made to exclude the cecum, but patient died from the operation.

Case II.—Male, aged sixty years. Gastric disturbance for years, with vomiting at times and a yellowish skin. For six months he had been constipated, but had had no true crises of

occlusion. The exploration revealed a small cancer at the splenic flexure. The affected loop of intestine was exteriorized and eight days later resection was performed, with semicircumferential anastomosis. The patient made a good recovery, and six months later the splenic anus was closed. Death followed, due apparently to duodenal hemorrhage.

Case III.—Male, aged sixty-six years. Intestinal occlusion. Laparotomy and division of two bridles, which compressed the small intestine. Cancer of splenic flexure discovered. Cecal anus. Two weeks later colon exteriorized and growth ablated. Half circumferential suture, with resulting necrosis of a portion of the intestine. Was living and well three years later, and would not permit the splenic anus to be closed.

Case IV.—Male, aged fifty-nine years. Sudden intestinal occlusion. Cecal anus. Nearly six weeks later exploratory laparotomy. Recognition of cancer of the splenic angle. Immediate extirpation. Death from peritonitis.

Truesdale (two cases).—Case I. Female, aged sixty-three years. Acute obstruction present. Laparotomy with mobilization of the tumor and adjoining colon. Transverse colostomy. Twenty days later resection with lateral anastomosis, the closed ends being placed extraperitoneally in the abdominal wound as advocated by Bloodgood. Recovery. Seen thirteen months later, with evident uterine cancer.

Case II.—Male, aged sixty years. There was no obstruction, but rapid loss of weight and a growth palpable through the soft, flat abdomen. To distinguish between a growth on the greater curvature of the stomach and one at the sigmoid flexure *x*-ray pictures were taken. The greater curvature was seen to be smooth, pylorus normal. The transverse colon showed interference with peristalsis. The bismuth appeared to collect in an irregular mass toward the splenic flexure, beyond which was a short segment in which the bismuth showed canalization. On this evidence a diagnosis was made of cancer of the splenic flexure. After several days of preparation a laparotomy was

done. Resection of the tumor and a safe margin of the healthy colon. Anastomosis impracticable because of tension. Lateral ileosigmoidostomy done, with double exclusion. Cecostomy to drain the remaining closed colon. Recovery. In good health thirteen months later.

Abbott (two cases).—Case I. An adenocarcinoma of the splenic flexure in a woman, aged forty years. Eleven months before admission began to be troubled by constipation. This increased until four months later she exhibited absolute obstruction with vomiting. Spontaneous recovery. Two months later a second attack of stoppage, when a cecal fistula was instituted. Recovered again, with persistence of a slight sinus, which occasionally leaked. Constipation again returned, and there was on one occasion a four-day attack of vomiting. Was now losing flesh. When first seen the abdomen was distended and nothing could be palpated. Laparotomy. Growth at splenic flexure of colon. Right lumbar colotomy. Second stage deferred because of suppuration in anterior wound. After some weeks an extensive resection was performed, followed by lateral anastomosis. Good operative recovery.

Case II.—Male, aged sixty-five years. When first seen he was in the hospital with abdominal distention, obstipation, and vomiting. He had had a similar attack one year before. Relieved by use of laxatives. He had a second attack four months later, and was in the hospital five weeks. Since then he had had almost daily trouble. The distention suggested obstruction at the splenic flexure. An exploratory incision to the left of the median line failed because of distention. Wound closed and right lumbar colotomy performed. Eighteen days later second stage. Inflammatory adhesions held the mass up. The same operation as in preceding case. Drainage through a stab wound in the loin in both cases.

Souligoux.—Male, aged sixty years. Seized with vomiting. As he had suffered a long time with stomach trouble a diagnosis was made of stenosis of the pylorus. Concurred in by a number

of colleagues. Laparotomy. Cecum and ascending and transverse colon very voluminous, distended with gas. Stomach was entirely normal. At left angle of the colon a neoplasm, fixed and hard. This was exteriorized with difficulty and a cecal anus established. Patient died in the night.

Aaron.—Male, aged fifty-five years. Sick for past year with "stomach trouble" and had lost thirty-five pounds. Constipated and cachectic. About five months earlier exploratory laparotomy had disclosed a presumably inoperable cancer of the splenic flexure. For six months he was treated with vaccines. Was then operated on (extensive resection and anastomosis between hepatic flexure and sigmoid) and he died eight days later with hypostatic pneumonia. The growth was an adenocancer of the flexure in an advanced stage.

Wette.—This author briefly mentions 1 case which exploration showed to be large and inoperable.

Savariand.—Case reported by Bary. Female, age not given. Ileus of two days' duration; violent pain and complete occlusion. There was a history of two similar crises, two months and one month before, less prolonged and less severe. There was a tender point in the epigastrium a little to the left of the midline. There is no allusion to any preliminary diagnosis. Median laparotomy disclosed a dilated transverse colon, a loop of which was exteriorized. Twelve days later the cancer was excluded by an ileosigmoidostomy. The anastomosis functionated at first, but a fecal abscess formed and the feces escaped through the fistula. In eighteen days the cancer at the flexure was extirpated by resection and end-to-end anastomosis and the abdomen closed. Healing was marred by abscess formation, but ultimately there was complete recovery, the fistula healing spontaneously.

Mumford.—This operator cites an inoperable cancer of the splenic flexure, the first indication of which was an acute obstruction.

Veaudeau.—Prolonged history of partial obstruction with severe attacks. No blood in stool. Cecostomy done in presence

of acute obstruction. Position of tumor afterward determined by bismuth *x*-ray examination. Six weeks later the tumor, with adjoining bowel, was mobilized and brought out of the abdomen, without sectioning the mesocolon, the afferent and efferent arm being placed in apposition. The parietal peritoneum was closed around the colic peritoneum. One week later the tumor was removed with the cautery, the afferent and efferent loops sutured in contact. About three weeks later the enterotribe was successfully used and after two weeks the open ends of the colon were closed under local anesthesia. Finally the artificial anus was closed. Patient in excellent health, with normal bowel function at the end of two years. The cancer was scirrhous in type, annular in growth, and there remained a lumen of 8 mm. He reports 2 cases, as follows:

Case I (Passot).—Male, aged fifty-six years. Cancer at splenic flexure, with obstruction and peritonitis due to perforation of the cecum. Laparotomy with establishment of cecal fistula at the perforation and peritoneal drainage failed to save the patient. Autopsy revealed a large cancer at the flexure which was adherent to the pancreas, kidney, and stomach. (Cf. author's Case I.)

Case II (Patel and Murad).—Male, aged fifty-one years. Entered with symptoms of obstruction. Operation revealed a peritonitis but no mechanical obstruction. Cause of peritonitis not determined. Death. Autopsy revealed a cancer at the splenic flexure. Small, annular, stenosing. Colon dilated. No perforation. "Peritonite par propagation."

Peck.—Male, aged forty-seven years. September 12, 1909. Obstinate constipation for three months. Partial obstipation for two weeks. No blood in stools. Mass felt on deep palpation just below the left costal arch. Operation September 13, 1909. Cancer of the splenic flexure. Somewhat fixed to posterior parieties. Numerous enlarged glands in mesocolon were found. Distention of transverse colon. Growth, with adjoining transverse, all of the descending and part of the sigmoid, together

with accompanying lymph glands was mobilized and excised. Nineteen inches of bowel removed. Cut ends inverted, side-to-side anastomosis between transverse colon and sigmoid. Cigarette drain. Most of abdominal wound closed. Patient in marked operative shock, from which prompt recovery was made. Normal defecation on third day. Slight fecal leakage on sixth day, with spontaneous closure on fifteenth day. Patient was exhibited fourteen months later in excellent condition. Weight was ten pounds above normal. Growth described as advanced carcinoma, with a good deal of associated inflammation. Histology of lymph nodes not given.

Moynihan.—Female, aged sixty-two years. Diagnosis of malignant stricture of the splenic flexure and crises of subacute obstruction of bowel. After enemata the abdomen became hollow and the growth could be felt plainly. Laparotomy showed a distended transverse colon and a collapsed descending colon and sigmoid. Tumor is so adherent in all directions as to be inoperable. An ileosigmoidostomy was then performed. The patient at once improved and after an interval—not stated—the tumor was no longer palpable. Moynihan states that it is "almost" certain that it could not have been cancerous but "some form of chronic inflammation." The question is thus left open. Paul states that he is convinced that such cases may be cancer. (Cf. Syms's case.)

Huguier.—Female, aged fifty-nine years. Gave a history of crises of diarrhea and pain. Former went back for three years, while the latter were very recent. A large tumor was readily palpated. Nutrition was excellent. A renal tumor having been excluded by ureteral catheterization, a laparotomy was performed. The belly of the tumor was constituted by the splenic flexure. It was a fatty-looking mass which adhered to the abdominal wall, and after mobilization the colon was resected and an end-to-end suture applied. The growth was as large as two adult fists, and was surrounded by a layer of adipose tissue "*pericolite graisseuse*." The mucosa of the colon was the seat

of an annular mass of cauliflower appearance with ulceration. The tumor is called a cylindrical epithelioma.

Castaigne.—Female, aged forty-two years. For two years she had had some affection which could not be diagnosed. There was pain about the stomach and spleen, severe, occurring in irregular crises. Were found to occur very often, two or three hours after a meal. She also had these pains at times when at stool, and then they appeared to come from the stomach, which felt heavy. There was some radiation to the left shoulder, and at times she vomited. The syndrome was like biliary colic, only on the wrong side. She had had more or less stomach disorder since childhood. Her physicians therefore regarded her as a nervous gastropath. She consulted an expert neurologist, who confirmed this diagnosis. She was placed under a gastrologist's care, who found marked hyperchlorhydria. Examination of fecal matter showed absence of blood, and other abnormal constituents. For three months she improved on regimen. The painful crises then returned. She was radiographed, and a diagnosis made of cancer of the splenic flexure of the colon. The stomach was now found free from all acid whatever. Refusing to entertain the diagnosis of malignancy, the patient began to travel for her health, visiting cures and sanatoria. The diagnosis was an isolated gastropathy. She improved somewhat, and was told that the radiograph taken had no diagnostic value. She returned to Paris seven or eight pounds lighter; went to the Jura and regained her weight. The author was now consulted and ignored all former diagnosis (he was not told of the *x*-ray) He found that she was using some morphin and her physiognomy suggested carcinoma. Palpation revealed an abdominal tumor of uncertain localization. A splenic tumor could be eliminated. An *x*-ray was advised. Two different men examined her, and both agreed on the diagnosis, "neoplasm of the splenic flexure." Just as she was about to be operated on there occurred an intestinal hemorrhage with signs of peritonitis, and she died four days later.

Among the foregoing there are records of 43 cases since Madelung's paper in which the result of operation is stated. There are 21 primary recoveries and 22 operative deaths, a mortality of 51.1 per cent. In 14 instances the operation was palliative, while in 29 cases a radical removal of the growth was done. Of the latter, 17 survived the operation while 12 died following it; an operative mortality of 41.3 per cent. In these 29 cases the resection was done 19 times, either as a second-stage operation after enterostomy or with a coincident enterostomy at the time of the resection, and 10 times without provision for colonic drainage. Fourteen of the first group survived and 5 died, an operative mortality of 26.3 per cent. In contrast to this only 3 of the patients in the second group survived and 7 died, an operative mortality of 70 per cent., nearly three times as great as in the first group. This marked difference must be due in some degree to the fact that colonic drainage is a measure of safety and not entirely to coincident factors.

The records contain many reports of only 1 or 2 cases, and, as a rule, these are only published when successful. Again, we find reports in more than 30 cases in which there is every reason to believe that recovery did not take place, though the text is silent on this point, the presentation being from the pathological stand-point, or for the purpose of illustrating some point in symptomatology.

Making due allowance for all these sources of error we are inclined to believe the operative mortality in cancer of the splenic flexure is 60 per cent. or more, if all cases are included in which any attempt to operate is made. The records are wofully inadequate for determining the proportion of the 40 per cent. that continue in good health for a year or more. Madelung found only 6 cases in 83 that could be considered as cured (three to eight years). Rotter seems to have only 1 in 10. Veaudeau a possible 1 in 3. Only 1 of our 5 operated cases lived more than three months and he died in something over two years from peritoneal carcinosis.

It would be a matter of interest to determine the mortality and the probability of cure in cases that were operated prior to the appearance of acute symptoms, but we have been unable to satisfactorily do this. There are scattered records of at least 28 cases, in which operation was successfully undertaken in the presence of either obstruction or abscess formation, and curiously enough some of the most satisfactory and permanent results were obtained in spite of apparently hopeless conditions, *e. g.*, Bilton-Pollard, Sasse, Brewer, Truesdale, and temporary in Cases I and III of our series. It is thus evident that cancer of the splenic flexure, the failures notwithstanding, is a lesion with which surgery may successfully deal. Our problem, therefore, is to utilize the means at our disposal and make them more effective. The all-important question of an early diagnosis has been fully discussed. How urgently its general study is needed is emphasized by the fact that in more than two-thirds of the cases just cited all the evidence for a diagnosis was present many months before the patient came to operation, with an acute life-endangering complication.

There remains for consideration the actual surgical procedure which should be followed, first in the uncomplicated cases, and second in the complicated cases. Two principles obtain in the practice of various operators, and our study of the literature leads to the conclusion that successful results reward one much more often than the other. (See summary just given.)

These principles may be designated as the one- and the two- or more stage attack. In the first an attempt is made to eradicate the disease and completely restore the patency of the colonic lumen at one sitting. This is accomplished either by a closure of the severed ends of the colon and a lateral anastomosis or by end-to-end anastomosis.

The many-stage operation is variously accomplished. A preliminary cecostomy or colostomy is done. At a subsequent date the tumor and adjoining bowel is mobilized and brought outside of the peritoneal cavity, with the afferent and efferent loops in

contact, and excluded with tampons or peritoneal suture. At a third sitting the requisite amount of bowel is excised, the afferent and efferent stomata remaining open. As a next step the enterotribe is used to reëstablish the colonic lumen, and finally, if need be, the cecostomy and the colonic openings are closed. This, in general, is the Mikulicz operation. Paul modifies it by removing the segment of colon and placing large glass tubes securely in the open ends of the colon at the second sitting. It is further shortened by various reporting surgeons by dispensing with the primary artificial anus. Others do the lateral anastomosis also at this sitting, so as to eliminate the later use of the enterotribe.

Most writers agree that the many-stage operation or its modification is safer than the other, and strongly advocate it in spite of its long incapacitating and unpleasant course (*e. g.*, Mikulicz, Madelung, Rotter, Paul, Veaudeau). Our collected cases show a mortality approximately three times greater in the one-stage than in the many-stage procedure. Careful study indicates that the failures in the one-stage operation would have been avoided by the other mode of attack. These failures arose almost entirely from leakage somewhere along a suture line, with a resultant peritonitis or improperly drained abscess (Case II in our series).

In the final analysis it must be accepted that greater safety is maintained by the abandonment of the one-stage operation. There is a definite field for it in cancer of the more mobile parts of the colon but not in the fixed inaccessible splenic flexure.

Naturally, its abandonment is imperative in the complicated cases. In the presence of obstruction or abscess formation it is foolhardy to attempt a radical operation. It is absolutely needful that a preliminary drainage of the colon be established and a sufficient time be allowed for recovery of the inflamed proximal bowel before any resection is attempted.

One additional point of importance remains to be discussed, *i. e.*, the extent of bowel to be removed with the contained tumor.

As pointed out, the flexure itself, with its immediately adjoining colon, particularly on the distal side, presents a considerable surface devoid of peritoneum. The absence of a circumscribing longitudinal muscular coat in the colon leaves a very thin wall where both peritoneum and muscle are lacking. Suturing such portions is therefore a matter of difficulty and uncertainty. Moreover, the mobilization of the distal transverse colon and the proximal descending colon is sometimes not sufficient to bring the two into close alignment. (See Case III.) Tension results, and renders the suture line still more precarious. All these difficulties are surmounted if one frankly sacrifices the distal half of the transverse, and the entire descending colon. The remaining transverse colon and the sigmoid are readily mobilized to a sufficient degree to lie in close parallel contact, and both are covered with peritoneum, practically throughout. These facts make their immediate lateral anastomosis easy, or give ideal conditions for the subsequent use of the enterotribe.

The following conclusions sum up the results of the study of our own cases and of the additional ones we have been able to find in the literature.

Conclusions. 1. The splenic flexure is the third most common site for the growth of colonic cancer.

2. This growth tends to the production of obstruction with indeterminate premonitory symptoms.

3. This complication is acutely present in nearly three-fourths of the cases coming to operation.

4. A recognition of the foregoing facts and a more careful detailed study, with a possible exploratory operation, should lead to an early diagnosis in a majority of the cases and thus forestall an acute complication.

5. The probable operative mortality of all cases up to the present time is over 60 per cent., and the percentage of prolonged cures is exceedingly low, 10 per cent. to 25 per cent.

6. These appalling results are largely due to the delayed diagnosis and an improper mode of attack.

7. The latter should follow the principle of the two- or more stage operation with provision for external colonic drainage, either as a preliminary or at the time of resection; always the former in the presence of serious obstruction or abscess formation.

8. The distal portion of the transverse colon, the flexure and the entire descending colon must be resected in order to obtain the requisite conditions for a secure anastomosis with an ultimate patency of the colonic lumen.

9. Notwithstanding the meager success thus far obtained, attention to the lessons learned from the successes and failures of those who have worked in this field justify the hope that this lesion may be as satisfactorily dealt with as cancer in other parts of the body.

My sincere thanks are expressed to Dr. Edward Prebel who gave me invaluable assistance in the study of the literature.

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DISCUSSION

Dr. William J. Mayo, Rochester, Minn.:

Our experience quite agrees with that which Dr. Hartwell has brought out in his interesting contribution.

We also have noted the tendency to perforation in some of our cases. In spite of this, however, we have not hesitated, in a few instances, to make the resection but provide for extensive drainage. Nature has many energy-saving devices for controlling movements of the intestinal contents. The large intestine proximal to the sigmoid flexure is derived from the midgut and has a great capacity for digestion and absorption of both fluids and solids, not only through its own secretions but from enzymes which have been carried down with the intestinal contents from the small intestine. The splenic flexure is held high by holding bands which mechanically retard the movement of the intestinal contents onward and prolong its stay in the absorbing proximal colon. This is an economic device for saving the energy which would have been required if a sphincter had been established for this purpose.

One technical step in the operation we have found of great value is mobilization. The outer holding layer of the large intestine is derived from the peritoneum and contains no bloodvessels of importance, with the single exception of the splenic flexure. The main band of the splenic flexure is derived from the omentum, and contains bloodvessels of considerable size which must be tied. By opening through the outer layer of peritoneum above and below the holding band at points which can be seen, the fingers may be pushed underneath so as to grasp the entire holding ligament of the splenic flexure when it may be drawn down sufficiently to catch the structure with forceps. On division the entire splenic flexure at once becomes mobilized and can be drawn well outside the abdomen.

One very interesting feature of obstruction of the colon, especially obstruction in the vicinity of the splenic flexure and descending colon, is the so-called distention ulcer of Kocher in the cecum. We have observed two such: one following a colostomy, and the other a resection. The cecum perforated several days after the operation, although in each case the obstruction had been relieved. These distention ulcers of the cecum and ascending colon are a frequent cause of death in acute and subacute obstructions, both in unoperated cases (two cases) as well as following operation. The condition may not be noticed at postmortem in the extensive suppurative peritonitis present. Such ulcers and perforations, I believe, are not entirely

due to distention but are the result of metabolic changes in the cecum itself, as the result of toxic material in the contents. As a rule the ulcers are quite acute and do not often show any great amount of callus.

Dr. Arthur D. Bevan, Chicago:

I want to say one word in regard to the difficulties in diagnosis of carcinomas of the splenic flexures. We have had two rather singular illustrations on our service this year. One, a very simple carcinoma of the splenic flexure associated with a hernia of the diaphragm. Part of the stomach had passed above the diaphragm into the thoracic cavity and that was detected by the *x*-ray examination showing definitely the relation of the stomach to the thoracic cavity. The very small carcinoma of the splenic flexure was not detected. At the time of the operation I repaired the hernia but did not detect the carcinoma. This was very small, almost circular, very narrow and was undoubtedly the etiological factor producing the hernia of the diaphragm. The woman died and we got an examination showing this carcinoma. I cite this to show the difficulty of diagnosis. The second case was a man who had a severely acute attack of abdominal pain, and *x*-ray showed a large stone in his kidney. He had associated with this attack what was interpreted as reflex ileus from the kidney stone, but he kept blowing up and blowing up so badly that finally the specialist called me in and I did a colostomy to save his life. After the colostomy an *x*-ray examination, filling the colon with barium, showed a carcinoma of the splenic flexure which was really the cause of the obstruction. I think these cases show very well the difficulty of diagnosis in carcinoma of the splenic flexure.

CONGENITAL ELEVATION OF THE SCAPULA (SPRENGEL'S DEFORMITY)

By J. F. BINNIE, A.M., C.M., F.A.C.S.
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Bradford and Lovett (*Orthopedic Surgery*, 3d ed., p. 391) write: "This condition is a somewhat unusual congenital deformity in which one scapula is raised in its relation to the thorax and clavicle and also to the opposite scapula. The scapula is not only raised but generally so rotated that its lower angle approaches the spine. Scoliosis is likely to exist in connection with it, and in some cases asymmetry of the face and skull has been noted; the affection is rarely bilateral. One or more of the scapular muscles may be absent and bony anomalies are frequent. In one class of cases a bridge of bone connects the scapula and the vertebral column; in another class there is a long piece of bone projecting upward from the superior border of the scapula but not articulating with or attached to the vertebræ. In other cases there is no bony outgrowth and no deficiency of muscles. In some cases the projecting upper border of the scapula is so noticeable in its elevated position that it is mistaken for an exostosis." The foregoing may be taken as the type of description of Sprengel's deformity given in works on orthopedic surgery and as a correct representation of the usual conditions encountered.

One of the most complete dissertations on Sprengel's deformity is the thesis of A. E. Horwitz (*Am. Jour. Orthop. Surg.*, November, 1908). Horwitz finds that 25 per cent. (34 cases) show a bony, fibrous, or cartilaginous attachment of the scapula to the vertebral column. Twenty-seven of these were bony. This

usually runs from the superior median angle or the upper third of the median border to the transverse process of a cervical (fourth to seventh) vertebra. The osseous union is usually by means of a triangular-shaped bone whose base rests upon the scapula and whose apex rests upon the transverse process of the vertebra. Its union is either by means of cartilage at one or both ends or by direct bony growth without cartilaginous intervention.

Many theories have been advanced regarding the etiology of the accessory bone. Some (Rager) think the presence of the bone a mere accident in the deformity, others think the bony growth primary.

Fairbank (*British Jour. Surg.*, i, 570) summarizes a series of 18 cases of congenital elevation of the scapula as follows:

"The sex of 8 was male; of 10, female. The right scapula was affected in 6 cases, the left in 9, while in 3 the deformity was bilateral. The scapula was anchored to the spine in 7 cases: in 2 of these both scapulæ were fixed, in one by a bridge of bone on both sides, and in the other by bone on the right and fibrous tissue on the left. Scoliosis was present in 10. In at least 4 a wedge-shaped half-vertebra was present. In one of these, at the age of two years, there was no curve, but by six years a low dorsal curve toward or rather below the elevated scapula, and quite unconnected with the half-vertebra, had developed. In 5 the dorsal convexity was directed toward the raised shoulder, in 4 away from it, while in 1 case with an abrupt curve both scapulæ were elevated.

"Partial fusion of ribs was seen in 7 cases, one of these being open to doubt. An unmistakable cervical rib was present in 2 cases only. In 2 there was total suppression of one or more vertebræ, while in 4 cases, including the two just mentioned, there was present a half or wedge-shaped vertebra. In 3 other cases the shortness of the neck made suppression of vertebræ more than probable, but the difficulties encountered in taking radiograms prevented a definite decision being arrived at. In 2 cases a projection or exostosis was present at the vertebral border of the scapula.

"With regard to other deformities present, 3 cases displayed torticollis, 2 of them having both scapulæ elevated. The radius was absent in 1, the pectoral muscles were imperfect in 2, and facial asymmetry was noted in 2, only 1 of which was associated with torticollis."

Walsham and Willet, quoted by Horwitz (I am using Horwitz's paper very freely), promulgate three hypotheses.

1. That the bone was formed in connection with the vertebræ and afterward became ankylosed to the scapula.

2. That it was primarily scapular and later became fused to the spine.

3. That it was found independently both of spine and scapula.

These authors support their second hypothesis opining that the bridge of bone is an "abnormal development of the suprascapular epiphysis, which normally exists as a narrow bridge of bone along the posterior border of the scapula, and consequently as homologous to the suprascapular bone of some of the lower vertebrates" (*e. g.*, the frog). Minot thinks the scapula, as other structures, is developed in a sheet. This sheet is continuous with that of the vertebræ, and centers of ossification appearing between the two points, a continuous band of bone is formed. Horwitz naturally tends to Minot's views and writes, "A suprascapula, if we regard this overgrowth as such, would extend from the lower portion of the scapula, whereas this extends from the upper third, with a broad base of attachment." Some of the theories as to the causation of Sprengel's deformity are:

1. Intra-uterine pressure from lack of amniotic fluid (Sprengel, Bradford, etc.).

2. Malformation of scapula part of a general maldevelopment (Kirmission).

3. Arrest of development due to amniotic adhesions (Schlange).

4. Exostoses and muscle contractions due to periostitis (Eulenberg).

5. The scapula is developed at a higher level than it maintains at birth. Retention of the fetal position is the cause of the deformity according to Chievitz.

6. Injury at time of birth as has been demonstrated in torticollis (Goldthwait). Contraction of sternomastoid (Kayser); defective rhomboids (Lameris); defective pectorals (Schlessinger); defective trapezius (Kausch).

Horwitz accepts the theory of Rabel that the deformity is due to defective descent of the scapula.

The case which is here reported presents some marked peculiarities.

M. T., aged four years.

September 7, 1911. Two years ago fell out of bed; was found lying on her back. A physician diagnosed fracture of the clavicle. Her parents, unusually intelligent and watchful, had noted no peculiarities in her shoulder before the accident.

At present patient suffers no pain but cannot raise the shoulder. A flat bony tumor reaches from the inner edge of the left scapula along the rhomboids to the spine and almost, if not quite, to the occiput, causing visible deformity. The mass is firmly attached to the scapula, its upper edge is sharply defined on palpation, and can be grasped between the fingers.

The scapular spine is much more vertical than is its fellow, the inferior angle of the scapula is displaced inward and upward. The clavicle is intact. Arm motion is normal. The shoulder action is very defective, owing to the scapular immobility and deformity.

X-ray shows the mass of bone separated by a clear line from the scapula (Fig. 1).

On operation the upper part of the trapezius was split, exposing a flat bone united to the vertebral edge of the scapula by a layer of cartilage one-fourth inch wide. The bone lay in a fibrous membrane identical with the periosteum. The bone reached to near the occiput and one rounded corner of it extended just beyond the middle line of the back. The bone and its cartilaginous connection with the scapula were excised as also the periosteum (Fig. 2). The periosteum was sutured over the raw edge of the scapula. (According to Quain the rhomboideus minor rises from the seventh cervical and first dorsal spines and

the ligamentum nuchæ, to be inserted into the base of the scapula opposite the triangular surface at the commencement of the spine. The rhomboideus major lies immediately below, being inserted into the vertebral edge of the scapula between the spine and angle. Variations, however, occur, *e. g.*, "an additional muscle has been observed running close and parallel to the upper border of the minor from the scapula to the occipital bone, and has been called the rhomboideus occipitalis, after a similar muscle occurring in some animals.")

FIG. 1

The wound healed satisfactorily, but by March 16, 1912, there was recurrence of the trouble.

April 4, 1912. There is a new formation of bone arising from the vertebral border of the scapula from its spine to its inferior angle and reaching to a point about one inch to the opposite side of the vertebræ. This bone is in two pieces, both firmly attached to the scapula by cartilage (Fig. 3). This bone was excised along with the muscle in which it lay. Periosteum was sutured over the cut edge of the scapula. Another mass of

bone (Fig. 3) $1\frac{1}{2}$ x $\frac{1}{2}$ x $\frac{1}{2}$ inches, lay parallel and close to the spines of the vertebræ on the left side, but not attached to the bone lying in the rhomboideus major. This was also excised. A bony prominence was noted arising from about the angle of the first and second ribs, but this was not removed, as the patient was not taking the anesthetic satisfactorily.

FIG. 2

July 26, 1912. Almost perfect motion reported.

February 12, 1913. There is a prominence of the scapula on the left side anteriorly above the clavicle and nearly directly above the coracoid. The left shoulder droops and thus prevents complete abduction, otherwise shoulder motion is good. There is no recurrence of the bony neoplasm.

This case, so far as concerns the osseous new formations, corresponds closely if not precisely to cases of myositis ossificans, but it also corresponds to Sprengel's deformity. In view of the recurrence of the bony neoplasm after thorough removal one is led to the belief that the neoplasm is not congenital and not dependent upon Sprengel's deformity, but that the Sprengel

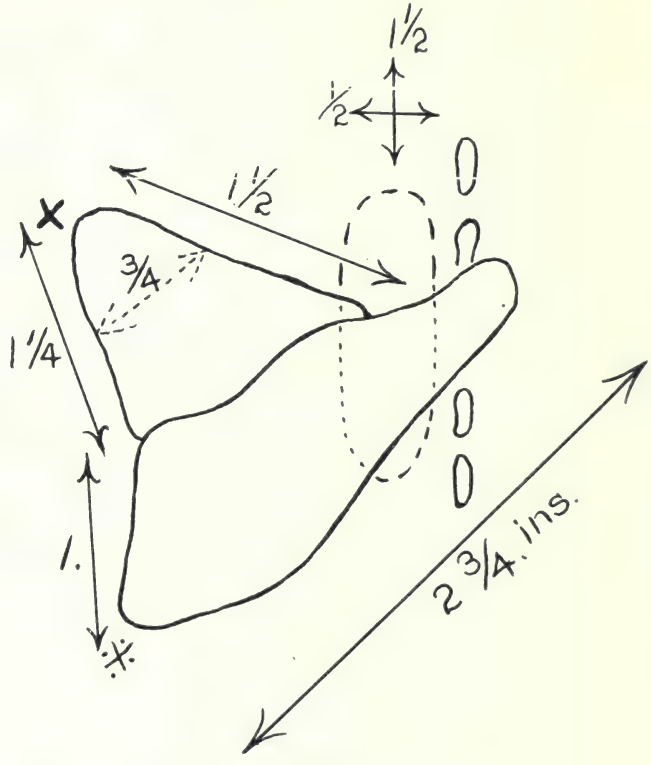

FIG. 3

deformity, *i. e.*, elevation of the scapula, may in some instances be dependent on the bony new formation.

The recurrent mass had wider attachments than the primary and involved fresh muscle. Also, there was the mass in the erector spinæ muscles which did not correspond with the typical findings in Sprengel's deformity.

ORIGINAL CONTRIBUTIONS OF AMERICA TO MEDICAL SCIENCES

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Upon reflecting on the awakening of the scientific spirit in America within the last twenty-five years, it occurred to me that it would be very interesting to study the achievements made especially in the form of original contributions by America to the medical sciences.

In this essay I shall confine myself to the United States of America. America is barely more than a century and a half old, but in that century it has contributed more than any other single century of the Old World, barring the century of Pasteur and his followers; and yet with transmissibility of puerperal fever, anesthetics, general and local, gynecology, abdominal surgery, dentistry, eradication of yellow fever, and malarial fever, it follows closely in the trail of the Pasteur century.

By original contribution is meant something new that has not been done before by somebody else.

In some instances it is difficult, from the description, to decide if the contribution has been made in America for the first time or for the first time in the world. Doubtless a great number were made in America without any knowledge that they had been done before by somebody else, and that is quite creditable in itself.

To obtain information, I have sent out over 600 circular letters to as many men occupying prominent positions, and who ought to know what has been done in the profession in this country.

Through the courtesy of the editor the circular letter was published in the *Journal of the American Medical Association*. It required eight months to gather the data and write the paper. It was truly a labor of love to bring together the workers of our country.

I here thank all those who assisted me in this self-imposed task for the common good and honor of America.

I have received a great number of titles and publications, but many are not mentioned here because the authors have not complied with the request to tell in a few words in what point each publication is new and had not been done before by somebody else. I will follow the alphabetical order of the various States and the chronological order of birth date and date of achievement of contributors and present to my readers their claim to originality. For details, letters may be addressed to the contributors still living. The town address is mentioned after the names. The names not found in the *Medical Directory* are deceased. Names without dates are those of contributors still living. The towns affixed to the names of the contributors are the towns in which they have done their most important work, not their birthplaces.

ALABAMA

Dr. J. Marion Sims (Montgomery), 1813-1883, invented the duck-bill speculum, which is the first and only instrument that will fully cause dilation of the vagina and afford a thorough view and access to its interior and the os uteri. He devised the left lateral posture for vaginal examination and operation. He was the first to make the cure of vesicovaginal fistula a success instead of the reverse. He invented all the instruments used in the operation for vesicovaginal fistula. He is the founder of gynecology, that art and science so eminently American. He was the first to write a modern book on gynecology (*Clinical Notes on Uterine Surgery*, 1866). He was the first surgeon in America to devote himself exclusively to the treatment of diseases of women. He advocated vaginal cystomy for chronic

cystitis. He first cured vaginismus by removing the remains of the hymen and resection of the tissues (1861). He first amputated the cervix uteri and covered it with vaginal mucous membrane. He first formally introduced silver wire in surgery. He devised a repositor for uterine displacements. He, in 1837, removed the lower jaw without external mutilation, the operation being done entirely from within the mouth. He performed originally the operation of cholecystotomy without the knowledge of the fact that Dr. Bobbs, of Indianapolis (1868), to whom he always accorded full credit, had preceded him by a few months. He narrowed the vagina for the cure of prolapsus uteri (1856). He was one of the first to advocate the careful aseptic invasion of the peritoneal cavity for the arrest of hemorrhage, the suture of abdominal wounds and the cleansing of the peritoneal cavity and for all intraperitoneal conditions (1881). He was the first to build a woman's hospital in the United States. He was the first American surgeon who compelled European surgeons to recognize the worth and fame of American surgery. He was the first American surgeon to receive decorations from European monarchs. He was the first physician to whom a life-size statue was erected in a public park or elsewhere in America. He was the only surgeon in the world who could go to any capital and secure a lucrative practice. His charming autobiography is unique in its kind. The late Professor T. Gaillard Thomas, of New York, in an address said that if he were called upon to name a few men who in the history of all times had contributed the most to relieve the sufferings of humanity he would include Marion Sims.

Dr. Nathan Bozeman (Montgomery), 1825–1905, devised the button suture for vesicovaginal fistula. He was the first to treat pyelitis by irrigation of the kidney by means of a catheter introduced up the ureter through a vesicovaginal opening (1888). He is also credited with having created a vesicovaginal fistula to cure chronic cystitis (1861).

Dr. Josiah C. Nott (Mobile), 1804–1873, was the first to advance the theory that yellow fever was transmitted by the mosquito (1848), but he demonstrated nothing. He was the first

to perform excision of the coccyx for coccygodynia (1844), preceding Sir James Y. Simpson.

Dr. Henry S. Levert (Mobile) (deceased, no dates) first demonstrated the innocuous character of the metallic ligature.

ARKANSAS

Dr. Thibault (Scott) discovered the anesthetic properties of quinin and urea hydrochloride (Crile).

CALIFORNIA

Dr. Samuel Elias Cooper (San Francisco), 1822–1862, founded the first medical college on the Pacific slope (1858), called later on, by his nephew, Dr. Lane, the Cooper Medical College. He first proclaimed that atmospheric air admitted into joints or other tissues is not a source of irritation or injury; also that the only true mode of treating ulcerations of bone within a joint is to lay the joint open freely; also that there are no known limits beyond which a tendon will or cannot be reproduced after division. He was the first to offer a course in operative surgery on animals. He announced a new cure for aneurysm, consisting of cutting down on the sac and sewing up from the outside. He advocated the ligation of arteries with their accompanying veins as being less dangerous than ligation of the veins alone. He operated for club-foot by cutting all contracted parts down to the bone, much as was later done by Phelps, of New York.

Dr. Levi Cooper Lane (San Francisco), 1833–1902, claims to be the first to perform vaginal hysterectomy in America. He originated an operation for craniotomy for microcephalus. He wrote a complete monograph on the *Surgery of the Head and Neck*. It is said that he was the first to ligate simultaneously the two common carotids with success in the same patient (1887).

Dr. Thomas W. Huntington (San Francisco) devised an operation of bone transference, wherein the fibula is made to

take the place of the shaft of the tibia. He believes he is the first, at least in America, to have done this.

Dr. George H. F. Nuttall (San Francisco) first summarized the role of insects, arachnids as transmitters of bacteria and parasitic diseases (1899) and introduced the precipitin test for different kinds of blood (1904).

COLORADO

Dr. Clayton Parkhill (Denver) was the first to use plates in the treatment of fractures. His apparatus consists of two pairs of long screws partially driven into the fragments and fixed at their other extremities to two wing plates. The blades are superimposed and glide. They are fixed with a clamp when the fragments are brought in apposition. The apposition is perfect at all times. When the wound is stitched the plates are outside of the tissues, not in contact with the bone. The method is published in the Transactions of the American Surgical Association of 1897. Dr. Leonard Freeman, of Denver, was a witness to the work of Parkhill, and says that if similar work had been done abroad before Parkhill knew nothing about it.

Dr. Charles D. Spivak was one of the prime movers of the medical library movement; introduced an esophagometer (1901) and other improvements in gastro-enterology; method of determining specific gravity in the living subject (1915).

Dr. E. Stuver (Fort Collins). The intrarectal injection of normal salt solution in typhoid fever is a blood-washing process, eliminating poisons or toxins from the system, and, so far as I can find, had not been before recommended for that purpose in this disease. The application of cocain and adrenalin to the inside of the nose prevents a large amount of the vomiting and shock during operation; this has been corroborated by Albert, Abrams, Crile and others, but as their work has been done since my original communication, I believe the idea was original with myself.

CONNECTICUT

Dr. Hezekiah Beardsley (1748–90) first described congenital hypertrophic stenosis of the pylorus (1788).

Dr. Mason Fitch Cogswell (Hartford), 1761–1830, was the first in America to ligate primitive carotid artery for primary hemorrhage in its continuity (1803).

Dr. Nathan Smith (New Haven), 1762–1809, first trephined bones for abscess before Brodie. He first dropped the pedicle after operating for ovarian cyst. He first advised the use of bichloride of mercury. He was the first in this country to amputate the knee joint (1824).

Dr. Jonathan Wright (New Haven), 1789–1865, was the first to cure a popliteal aneurysm by digital compression (1847).

Dr. Nathan Ryno Smith (New Haven), 1797–1877, was the first to reduce a hip-joint dislocation by manipulation. He devised the Smith anterior splint for fractures (1860). He advocated the principle of suspension in the treatment of fractures (1827).

Dr. John M. Riggs (Hartford), a dentist, 1810–1885, was the first to devise the scraping treatment for Rigg's disease, now known as pyorrhea alveolaris, first described by Pierre Fauchard in 1746.

Dr. R. Erdman (Salem, New Haven), indefinite life of the trypanosomes. By employing the plasms of the host as a culture medium either for trypanosomes themselves or the growth in vitrio of various infantile tissues of the host he succeeded in keeping trypanosoma brucei in normal condition for an indefinite period, whereas they die in a few days in other culture media.

Dr. Thomas B. Osborne (New Haven), work on vegetable proteins (1907–9) and on artificial foods (with L. B. Wendel).

Dr. Charles B. Davenport, work on heredity and eugenics (1906–15).

Dr. William T. Sedgwick (Hartford), work on biology and sanitation.

Dr. Graham Lusk (Bridgeport), important work on metabolism and diabetes.

DISTRICT OF COLUMBIA, WASHINGTON CITY. UNITED STATES PUBLIC HEALTH SERVICE

Dr. Henry R. Carter was the first to find out that a house in which a first case of yellow fever has occurred becomes dangerous only after twelve to fifteen days of the occurrence of the first case. Dr. Walter Reed availed himself of this fact and waited fifteen days before a mosquito which had bitten a case of yellow fever was made to bite a healthy subject. Thus he succeeded in transmitting yellow fever through the mosquito when others had failed.

Dr. Rupert Blue was the first to rat-proof a whole large city (San Francisco).

Dr. Charles W. Stiles claims the following: Enlightenment of the sheep raisers of the country on the question of sheep scab and their deliverance from the patent dip man. The prophecy on largely theoretical grounds that a portion of the death-rate among the seal pups of Alaska will be found to be due to hookworm, and that his views were confirmed. The prophecy on theoretical grounds that the hookworm disease would be found to be a common infection in the Southern States, which prophecy was later confirmed by him. Hookworm in man in the United States is caused by a species of parasites distinct from that described by Dubini. The utilization of protozoön spores to prove that people eat human excrement. As a lever to prevent disease this protozoön test is very important. Issuance of an *Index Catalogue of Veterinary and Medical Zoölogy* jointly with Dr. Hassall. It will doubtless be the standard work of reference on the subject for many years to come. Description of a number of new species and new genera of parasites, including Necator americanus, the American variety of hookworm.

Dr. Rupert Blue, Surgeon General of the Public Health Service, mentions especially as original contributions from the Public Health Service: Original research work done by Rosenau and Anderson on the phenomenon of anaphylaxis, as described in *Hygienic Laboratory Bulletins* Nos. 29, 30, 36, 50, 64 and 80.

Standardization of diphtheria and tetanus antitoxin, as described in *Hygienic Laboratory Bulletin* Nos. 21 and 23. The discovery by Miller of a new animal parasite, Hepatozoön perniciosum, described in *Hygienic Laboratory Bulletin* No. 46. The studies on leprosy by Clegg, Brinckerhoff and McCay, described in *Public Health Bulletins* Nos. 26, 27, 28, 33, 39, 41, 50, 61 and 66. Studies of plague by McCay in *Public Health Bulletins* Nos. 43 and 53. Stiles' identification of a new species of hookworm in America, Necator americanus. Francis's "Studies of Tetanus," described in *Hygienic Laboratory Bulletin* No. 95. The work consists in multiple tests of the vaccine virus of tetanus, rendered necessary by the varied flora found in vaccine virus. Goldberger's recent investigation of pellagra described in *Reprint* Nos. 218 and 228 from the *Public Health Report*. Pellagra is caused by a faulty diet. No pellagra develops in subjects who consume a mixed, well-balanced and varied diet. Rosenau and Bruer reported the transmission of poliomyelitis by the stable fly (Stomoxys calcitrans) in monkeys.

Dr. John T. Anderson, director of the Hygienic Laboratory, says that in his publications on measles the part that is new is the discovery of the susceptibility of the monkey to the virus of measles, the determination of the period of infectivity of measles blood for the monkey, the first definite information as to the nature of the virus of measles, the means of exit, the virus from the blood, and the probable avenue of infection. In addition the experimental work on measles gives us our first laboratory results upon the duration of the infectivity of the secretions from the nose and throat. Also the non-infectivity of the scales of desquamation from cases of measles was demonstrated. In the papers on typhus fever the points that are new are the demonstration of the susceptibility of various species of monkey to the typhus fever of Mexico, the determination of the relationship of "Brill's disease" (what we now know as mild typhus), the transmission of mild typhus fever from monkey to monkey by the bite of the body louse and probably also by the head louse. A number of facts detailed in the publications in regard to the

nature of the virus of typhus fever were also new and had never been published. The papers on anaphylaxis, of which I was the joint author, give the pioneer work upon this important phenomenon. The first paper upon anaphylaxis to be published in the United States and the first paper ever published anywhere giving an intimate account of the mechanism of anaphylaxis was published from the Hygienic Laboratory, and of which Dr. Rosenau and I were joint authors. These three pieces of work—that on measles, that on typhus fever, and that on anaphylaxis—with all three of which I was associated, covered investigations of a pioneer character and brought forth new facts that had never previously been brought out.

The Hygienic Laboratory of the United States Public Health Service is a contribution to medical science. It is perhaps the finest of its kind in the world.

UNITED STATES ARMY MEDICAL CORPS

Dr. Benjamin Rush, 1745–1813, published the first pamphlet on military hygiene (1777), the first American treatise on insanity (1812), the first American contribution to anthropology (1774–88), the first account of cholera infantum (1775), the first account of dengue in English (1780).

Dr. John Jones published the first American book on surgery and military medicine (1775).

Surgeon-General Tilton organized the Medical Department of the Army (1812).

Dr. Barton organized the Medical Department of the Navy (1842).

Dr. James Mann, in 1821, first amputated at the elbow-joint.

Dr. William Beaumont (1825–1883) made the first classical investigation of gastric digestion, 1825–33. He experimented on the famous Alexis St. Martin, who had a gastric fistula in the pit of the stomach as a result of a gunshot wound.

Dr. John Shaw Billings: First excision of ankle-joint in America (January 6, 1862), with recovery of patient. *Index*

Catalogue of the Surgeon-General's Library, first series (1880–95). Planning and constructing of the Johns Hopkins Hospital (1876–89). Wrote the best history of surgery in the English language (1895). Did most to make the United States Census Reports reliable and valuable as statistics in his time.

Dr. J. M. Da Costa: First account of irritable heart in soldiers (1863).

Drs. S. Weir Mitchell (1822–1904), S. R. Morehouse, and W. W. Keen: Classical investigation of gunshot and other injuries of nerves (1864).

Dr. Joseph Janvier Woodward: Did the best work of his time in microphotography (1865 and subsequently).

The Medical and Surgical History of the War of the Rebellion (1870–1888), by Joseph J. Woodward, Charles Smart, George A. Otis and David L. Huntington, is a work unique in the annals of military medicine.

Dr. William A. Hammond, 1829–1900 (Surgeon-General): First description of athetosis (1873). First text-book on nervous diseases (1871).

Dr. Charles F. Craig in 1902 demonstrated that intra-corpuscular conjugation in the malarial plasmodia is the cause of latency and relapse, also the existence of malarial carriers. He demonstrated also, with Percy M. Ashburn, that the cause of dengue is a filterable virus transmitted by the mosquito, Culex fatigans (1907). He discovered paramoeba hominis, 1906.

Dr. Alfred A. Woodhull was the first in this country to employ the British-Indian method of giving large doses of ipecac in dysentery (1875–76).

Dr. George Sternberg: First isolated the bacillus of croupous pneumonia (1880). First manual (1898) text-book (1866) of bacteriology by an American writer.

Dr. Walter Reed (1851–1902) was the first to transmit yellow fever by the mosquito to a human subject. He demonstrated that the Stegomyia mosquito was the conveyor. Also that the mosquito had to bite the victim of yellow fever during the first three days of the fever. He succeeded in the trans-

mission of yellow fever because he availed himself of Dr. Carter's discovery and waited twelve to fifteen days before applying the infected mosquito to a healthy subject. He demonstrated that fomites did not carry yellow fever by causing healthy subjects to stay in bed in rooms with fomites and protecting them from mosquitoes.

Drs. Reed, Vaughan and Shakespeare first demonstrated that flies transmit typhoid fever (1898).

Dr. James Carrol (1854–1907) is the first case of a healthy subject bitten by an infected mosquito that had been kept twelve days to develop yellow fever.

Dr. William C. Gorgas: Rid Havana of yellow fever (1901). Rid the Isthmus of Panama of disease and made it habitable (1904–14). Investigated the cause of the high death-rate from pneumonia among the miners of the Rand, South Africa (1913–14). Was the first American physician to be called upon by a foreign power to investigate disease in its territory (sickness among the miners of South Africa). He was the first army surgeon to hold rank of Major-General in the United States Army and to be made Surgeon-General for life.

Dr. Frederick F. Russell: Rid the United States Army of typhoid fever by typhoid inoculation (1912).

Dr. Percy M. Ashburn discovered Microfilaria philippinensis with Craig (1906). The cause of dengue as a filterable virus transmitted by mosquito Culex fatigans (1907).

Dr. Edward B. Vedder proved that beriberi is a deficiency disease which can be prevented by a simple change of ration; substituted undermilled for polished rice; that the disease can be experimentally produced in puppies and fowls; and that the administration of an alcoholic extract of rice polishings will alleviate some of the symptoms in infants (1912–13). Was the first to demonstrate that emetin is a specific remedy in amebic dysentery (1911–14).

Dr. E. R. Gentry and T. L. Ferrenbaugh discovered that Malta fever is endemic in southwest Texas and is transmitted by goats on the ranches thereabouts (1911).

Dr. Louis A. Lagarde demonstrated that microörganisms are not destroyed by the discharge of gunpowder or projectiles in the act of firing but infect the wound (1892–1902). Has written the best recent treatise on gunshot wounds (1914).

Dr. F. H. Garrison: *History of Medicine* (1913) contains the finest detailed account of modern medicine down to the immediate present.

The Army Medical Museum is one of the finest contributions to medical science in America. It contains a unique collection of gunshot wounds of the bones gathered during the Civil War.

The Army Medical Library is a still greater contribution. It is the finest of its kind in the world.

The Index Catalogue and Index Medicus are most valuable contributions.

Dr. George T. Vaughan (Washington City): A new operation for the radical cure of inguinal hernia, by cutting the conjoined tendon and placing the spermatic cord behind it on the pubis. A new operation for circumcision by turning the outside skin of the prepuce which has been cut away. Stopping hemorrhage from bone by pressing soft tissues, muscles, etc., against it, *i. e.*, by plugging with soft tissues.

Dr. George Kober (Washington City): First to have published biographic sketches of notable physicians and surgeons of the present. First to publish notes on chronic dysentery treated with injections of a solution of chloride of potash. Also of adenitis treated with injections of carbolic acid and glycerin. Also a case of gunshot wound of the knee-joint treated with antiseptic injections of iodin and carbolic acid. Also that insects, and especially flies, are doubtless frequently the cause of spreading disease. Also to call attention to impure milk in relation to infant mortality. Also to have tabulated 330 milk-borne epidemics.

Dr. Joseph H. Bryan (Washington City) has contributed much that is new and valuable in the treatment of accessory sinuses of the nose, without resort to internal operation.

GEORGIA

Dr. Milton Antony (Georgia), 1789–1839, first excised the fifth and sixth ribs with a portion of gangrenous lung (1821).

Dr. L. A. Dugas (Augusta), 1806–1884, first to perform abscission of the cornea.

Dr. Crawford Long (Danielsville), 1816–1878, was one of the co-discoverers of anesthesia. He removed a small tumor from a negro's neck under ether anesthesia (1842). He published nothing. He died in obscurity.

Dr. Daniel, 1819, introduced the weights and pulley in the treatment of fractures.

Dr. Henry Fraser Campbell (Augusta), 1842–1891, discovered the excitosecretory system of nerves (1857). Invented several gynecological instruments. Devised the knee-breast position for vaginal examinations.

Dr. Robert Battey (Rome), 1828–1895, advocated, in 1872, the removal of both ovaries for dysmenorrhea and other aggravated troubles when the patient could not be relieved by any other method.

Dr. Maury M. Stapler (Macon): New instrument for the suction massage of the ear. It is an improvement on the Politzer and the use of the hard-rubber catheter. The theory, which says adenoids closing the Eustachian tubes partially or intermittently and the pathological sequence, rarification of the air in the middle ears causing unequal pressure on the tympanic membranes, pressing the ossicular chains upon the labyrinth, making the footplate of the stapes to impinge within the oval windows, attended by irritation, swelling, exudate of plastic serum, stretching and loss of contractile power of the stapedius muscle and fixation, amounting to a luxation of the stapes, is one cause of many cases of deaf-mutism—is new. The method of reducing the luxation of the stapes, by suction applied equally and at the same time to the ears through the external auditory canals and the Eustachian tubes and the instrument used—is new. The mechanical demonstration on a model to prove the principle

of physics, applied, is effective in moving the stapes and the entire ossicular chain—is new. The clinical proof, when a deaf-mute patient shows marked improvement after a course of treatment, is itself new, since the medical profession has seen no such improvement in the deaf by any other method.

Samuel J. Crowe discovered that hexamethylenamin is excreted in cerebrospinal fluid (1909).

ILLINOIS

Dr. Daniel Brainard (Chicago), 1812–1866, was the first to perforate the ends of fragments to wire the bones in fractures (1852).

Dr. Nathan Smith Davis (Chicago), 1817–1906, was the father of the American Medical Association.

Dr. Wm. H. Byford (Chicago), 1817–1890, originated the plan of dilating the opening of pelvic abscesses discharging into the rectum in order to secure efficient drainage.

Dr. Charles A. Kuford (Granville): Work on cell lineage.

Dr. Edmund Andrews (Chicago), 1824–1904, first added oxygen to nitrous gas to prolong the anesthetic effects.

Dr. Christian Fenger (Chicago), 1840–1902, was one of Chicago's great successful surgeons and first teacher of modern pathology. He was the first in Chicago to perform vaginal hysterectomy and one of the first there to explore the brain with an aspirating needle. He contributed a number of brilliant disciples to medical science. His influence over his generation has been tremendous according to his followers and admirers. Endoscopy of gunshot wounds (1871). Introduction of Listerian methods in Cook County Hospital (Chicago). Performing plastic operations on the ureter for stricture without resection. Described ball-valve action of stones in the common duct.

Dr. H. S. Jennings (Tonica): Work on animal behavior (1906).

Dr. Edmund B. Wilson (Geneva): Work on embryology, zoölogy and heredity.

Dr. Nicholas Senn (Chicago), 1844–1908. "Transplantation of Omental Flap (1887)." Animal experiments proved the possibility for reinforcing a line of intestinal suture or covering the neck of an intussusception (artificially produced). The flap was taken either from the margin of the omentum or from its middle, care being taken to use some portion supplied with a vessel of considerable size. Its base was left attached to the omentum. "Treatment of Compound Fracture by Bone Ferrule (1893)." The ferrule consisted of a ring of bone which is placed around the fragments (like a ring around a finger) and thus prevents lateral and longitudinal displacement. "Bloodless Amputation of the Hip-joint by a New Method Consisting of the Straight Incision of Langenbeck; Preliminary Dislocation of the Hip-joint." Soft tissues tunneled with a hemostatic forceps on a level with the trochanter minor to a point on the inner aspect of the thigh behind the abductor muscle. Elastic constrictors passed through tunnel and tied anteriorly and posteriorly, rendering operation bloodless. Amputation then completed in the usual manner. "Healing of Aseptic Bone Cavities by Implantation of Antiseptic Bone Chips." Osteomyelitic cavities first rendered aseptic and then implanted by decalcified bone chips, covered by periosteum. "Treatment of Fractures of the Neck of the Femur by Immediate Reduction and Permanent Fixation (1889)." Plaster of Paris cast of entire limbs, pelvic and opposite limb, as far as the knee. Lateral pressure over great trochanter by means of special apparatus incorporated in cast and consisting of a leather pad and thumb screw in order to regulate pressure and keep fracture reduced. "Rectal Insufflation of Hydrogen Gas as a Test in the Diagnosis of Visceral Injury of the Gastro-intestinal Canal in Penetrating Wounds of the Abdomen (1888)." Experimental and clinical experience showed the practicability of forcing gas through the ileocecal valve from the rectum and the possibility of diagnosing gastro-intestinal wounds by insufflation. "Experimental and Clinical Study of Air Embolism (1885)." These experiments were exhaustive, having been done on horses, sheep, cats and

dogs, and demonstrated positively the causes of an embolism. The great practical results of this work was the life-saving means proposed in desperate cases of air embolism; that is, puncture and aspiration of the right ventricle. The surgery of the pancreas as based upon experiments and clinical researches showed that restoration of continuity of pancreatic duct does not take place after complete section of pancreas (1886). Complete extirpation is invariably followed by death, produced either by traumatism or by gangrene of the duodenum. Complete destruction of the pancreatic duct uncomplicated by pathological conditions of the parenchyma of the organ never results in the formation of a cyst. "Movable Kidney." Fixation without suture. Removal of fatty capsule. Tamponnade of gauze around kidney. Healing by granulation. Gradual removal of gauze. "Gastro-enterostomy and Intestinal Anastomosis by Means of Perforated Decalcified Bone Plates (1886)." New incision for arthrectomy, resection and for reduction of irreducible dislocation of the shoulder-joint. The advantage is that the scar resulting from the operation is well protected. "Intestinal Surgery with Special Reference to the Treatment of Intestinal Obstruction." He made valuable experimental contributions to the study of air embolisms, the surgery of the pancreas, gunshot wounds and intestinal anastomosis in which he introduced the use of decalcified bone plates. He was the first to use roentgen rays in the treatment of leukemia (1903). He was a great master in the treatment of intestinal surgery, especially in the treatment of appendicitis. He was the first to demonstrate the possibilities and limitations of the surgery of the pancreas. He was the great educator of the West. He contributed very much to the spread of knowledge by his numerous publications. He was justly termed by his contemporaries the greatest surgeon, medical authority, and writer the West has ever produced. His studies on tumors, including the first comprehensive writing on this subject in this country, were enough to make him famous. He founded the Association of Military Surgeons of the United States (1891).

Dr. Ludwig Hektoen (Chicago): Work in pathology; experimental measles.

Dr. Frank Billings (Chicago): Focal infections.

Dr. Weller Van Hook (Chicago) (deceased, no dates): First successfully operated on a case of perforation in typhoid fever.

Dr. Belfield (Chicago) in 1886, first performed suprapubic cystotomy for hypertrophied prostate.

Dr. John B. Murphy (Chicago) (deceased): "Proctoclysis in the Treatment of Peritonitis." "Axillary and Pectoral Cicatrices Following the Removal of the Breast, Axillary Glands, and Connective-tissue for Malignant or Other Diseases." "Arsenical Treatment of Syphilis." "Actinomycosis Hominis, with Report of Five Cases." "Intestinal Approximation; Pathological Histology of Reunion and Statistical Analysis." "Surgery of Arteries and Veins Injured in Continuity." "First Successful End-to-End Union of the Artery in the Human." "Contribution to Abdominal Surgery; Ideal Approximation of Abdominal Viscera without Suture." "Clinical Significance of Cervical Ribs." "Significance of the Scalenus Muscle." "Fibroma of the Gastrohepatic Omentum in the Lesser Peritoneal Cavity." "Fibromyoma Telangiectaticum of the Gastrohepatic Omentum." "Fractures of the Olecranon Treated by Subcutaneous Extra-articular Wiring." "Fibromyoma Complicating Pregnancy; Fibroma of the Vaginal Wall." "Neurological Surgery." "Removal of an Embolus from the Common Iliac Artery, with Reëstablishment of Circulation in the Femoral." "Surgery of the Lungs." "Pneumothorax as a Treatment for Tuberculosis." "Some Further Advances in Renal Surgery, Plastic on Renal Pelvis." "Superior Accessory Thyroids." "Tuberculosis of the Patella." "Substitution of Quadriceps Tendon for Patella." "Tuberculosis of Female Genitalia and Peritoneum." "Tuberculosis of the Testicle, with Special Consideration of its Conservative Treatment." "Trigeminal Neuralgia Treated by Intraneural Injection of Osmic Acid." "Ankylosis; Arthroplasty, Clinical and Experimental." "Resection of the Rectum

per Vaginam." "Osmic Acid Injections for the Relief of Trifacial Neuralgia." "Early Operation in Perityphlitis" (in coöperation with Dr. E. W. Lee). "Operative Surgery of the Gall Tracts, with Original Report of Twenty Successful Cholecystenterostomies by Means of the Anastomosis Button." "Surgery of the Gasserian Ganglion, with Demonstration and Report of Two Cases." "Fibroma of the Mesentery." "Report of Case of Typhoid Perforation with Peritoneal Infection and Five Other Consecutive Cases of General Suppurative Peritonitis; All Recovered." "A Method of Dispensing with Rubber Gloves and the Adhesive Rubber. Use of Palate Mucous Membrane Flaps in Ankylosis of the Jaw, Due to Cicatricial Formation in the Cheek." "The Surgical Clinics of John B. Murphy, M.D." Although the foregoing publications contain more or less novel views, Dr. Murphy states that the following work, as far as he knows, has been done by no one else. "The End-to-end Suture of Arteries." "Proctoclysis in the Treatment of Peritonitis." "Arthroplasty of Joints with Interposition of Fat and Fascia." "The Button as a Means of Intestinal Anastomoses."

Dr. L. L. McArthur (Chicago): So far as I know I was the first to devise and recommend a muscle-splitting operation of the abdominal wall for any purpose, but especially for appendicitis. I devised a method of constructing a new urethra from the vaginal mucous membrane. I devised a method of suturing hernias with living sutures made from the tendons of the external oblique muscle: in other words, closing the hernia with living suture, which suture I demonstrated to be living for years afterward. I devised a novel method of treating the complications of bile tract diseases by utilization of the bile tracts for the introduction of fluid medicaments, etc., into the duodenum. I devised a new surgical access to the pituitary body, through an aseptic field, which method has been adopted by many operators, notably Dr. Frazier, of Philadelphia. I demonstrated the curability of tuberculosis of the large intestine by an appendicostomy, or cecostomy, the originality consisting in demonstrating the applicability of this method of approach to large intestine tuberculosis.

Dr. Allen B. Kanavel (Chicago): "Experimental, Anatomical, and Clinical Study of Infections of the Hand." In this work I have shown where pus will lie in the hand and forearm in any infection and the most satisfactory method of producing a rapid recovery with a functionating hand. A study of experimental work in relation to the union of fractures and splenectomy. In these I showed that the removal of the spleen bore no relation to repair in union of bones. "An investigation as to the Most Feasible Method of Removing Tumors of the Hypophysis." In this work I believe I was the first to draw attention to the fact that these tumors can be removed through the inferior portion of the nose rather than going through the superior portion, as had been previously done by Schloffer, von Eiselberg and others. "A Study of Duodenal Toxemia and Mobilization of the Duodenum." "Consideration as to the Osteoplastic Closure of the Canals through Which the Nerves Descend." Experimentally it was shown to be possible, and clinically it has been done, but the procedure has not been known long enough to determine whether or not it has established a principle that may be of value in these cases. "A Study as to the Question of the Relation of Thyroidectomy to Dementia Praecox." I believe that the investigation and report that I made on this condition, which was advocated by Halsted and others, has shown that it is absolutely of no avail. "Surgical Intervention in Leontiasis Ossea." "A Study of the Clinical Histories and Skulls in Relation to Curative and Palliative Operations, with the Report of a Case."

Dr. Albert E. Halstead (Chicago) was the first to propose and use the sublabial trans-sphenoid method of approach to the hypophysis cerebri.

Dr. Alex. H. Ferguson (Chicago) (deceased) devised a method of closing a vaginal fistula by cutting deeply around its periphery through the vaginal walls down to the bladder. The circular flap made in this way is inverted into the bladder and its raw surfaces approximated with buried catgut sutures after which the vaginal walls are sutured together, closing in the entire raw area.

Dr. Geo. Callahan (Chicago) first used acetone as a palliative to be applied to incurable cancer of the neck of the uterus.

Dr. Coleman G. Buford (Chicago) was the first surgeon in the West to perform bacteriological experiments with all kinds of gloves used in surgery, and was the first to present this question to a medical meeting in Chicago. Described a syndrome characterizing simple goitre, known as the Buford syndrome. Described the pathogenesis of goitre in children.

Dr. C. O. Whitman founded the *Journal of Morphology*, and did important work in embryology.

Dr. Emanuel J. Senn (Chicago): "Gastrotomy by a Circular Valve Method; Stomach Exposed." Incision $\frac{1}{4}$ inch in length made into its cavity as near cardia as possible. Tube introduced into stomach and then fixed by suture. A purse-string suture is passed around the tube at a distance of one-half inch from it. The suture is then tied. A second and third purse-string suture is passed in a similar manner and tied. Result, that the tube lies in a funnel-shaped inverted position of the anterior wall of the stomach. The stomach is fixed to the anterior abdominal wall.

Dr. J. Gordon Wilson (Chicago): The publication on the nerves of the atrioventricular bundle was the first published in which there was demonstrated the ganglion cells there present and their endings. The communication on the nerves and nerve-endings of the membrane tympany contains many new facts. The article on the nerves and nerve-endings in the membrana tympani of man is still the only communication on that subject. The papers on the labyrinth of the ear contain a number of new data in regard to the vestibular mechanism.

Dr. Franklin H. Martin (Chicago) contributed more than any other one man to the foundation of the American College of Surgeons, also to the *Journal of Surgery, Gynecology and Obstetrics*, which is quite a contribution to medical science.

Dr. William A. Locy (Chicago) did important work in embryology. *Journal of the American Medical Association* is the greatest contribution of its kind. It is unexcelled anywhere.

INDIANA

Dr. John S. Bobbs (Indianapolis) performed the first cholecystotomy (1868).

Dr. Miles F. Porter (Fort Wayne) claims to have originated the method of treating hyperthyroidism by injecting boiling water into the gland.

IOWA

Dr. John Bell (Waterloo) (deceased, no dates) was the first to perform gastrotomy for the removal of foreign bodies.

Dr. Alonzo E. Taylor (Alden) did important work on fermentation (1906), metabolism (1912), and application of physical chemistry to pathology.

KENTUCKY

Dr. T. H. Morgan (Lexington): Important work on experimental embryology, morphology, and zoölogy; also on heredity.

Dr. Ephraim McDowell (Danville), 1771–1830, was the first to remove an ovarian cyst. He did it in Danville in 1809. He operated on 13 cases with 8 recoveries. He is the founder of abdominal surgery.

Dr. Walter Brashear (Bardstown), 1778–1809, first disarticulated the hip-joint in 1806.

Dr. Benjamin Winslow Dudley (Lexington), 1785–1870, was the first to trephine for epilepsy (1828).

Dr. Henry Miller (Louisville), 1800–1874, was the first to make applications of fluid caustics to the body of the uterus by using a mop.

Dr. Charles McCreary was the first to remove the clavicle (1813).

Dr. John R. Wathen (Louisville): An improved technic in goitre operations. The use of scissors has replaced entirely the knife, and all structures, beginning with the skin, and later the enlarged thyroid gland, are elevated and approached from the under surface.

LOUISIANA

Dr. Francois Prevost (Donaldsonville), in 1830, performed the first Cesarean section in America. He operated four times successfully, losing but one mother and operating twice on the same woman.

Dr. Dubourg (New Orleans), in 1830, was the first to perform vaginal hysterectomy in America, if not in the world. (Statement of Professor E. S. Lewis, of Tulane.)

Dr. Charles H. Luzenberg (New Orleans), 1805–1848, first removed gangrenous bowel in hernia and sutured the ends successfully.

Dr. John L. Riddell (New Orleans), 1807–1865, invented the binocular microscope.

Dr. Warren Stone (New Orleans), 1808–1872, was the first to resect a portion of rib to secure permanent drainage in cases of empyema. He first cured a traumatic aneurysm of the second portion of the subclavian artery by digital compression upon the third portion of the vessel. He was the first to apply a wire ligature to a human artery for aneurysm. He applied it to the common iliac for an aneurysm of the external iliac. Digital compression is undoubtedly an American procedure.

Dr. Charles J. Faget, Sr. (New Orleans), 1818–1884, discovered the lack of correlation between the pulse and the temperature in yellow fever. While the temperature goes up the pulse goes down. It is pathognomonic of yellow fever.

Dr. Tobias Gibson Richardson (New Orleans), 1827–1892, was the first to amputate both legs at the hip-joint at one time in the same subject, the patient recovering. He was the first to write an *Anatomy* in which English names were substituted for the Latin names. He was the first to use strong injections of nitrate of silver for cystitis. His wife's devotion to his memory caused her to contribute magnificent buildings on Tulane Campus, devoted to medical education.

Dr. H. D. Schmidt (New Orleans), 1823–1888, demonstrated the origin of the bile ducts in the intercellular spaces.

Dr. T. W. Compton (New Orleans), in 1853, was the first to excise both the radius and ulna.

Dr. Albert B. Miles (New Orleans), 1852–1894, was the first to use a loop ligature on the first portion of the subclavian artery while operating on the third portion.

Dr. Andrew W. Smyth (New Orleans) was the first to cure a subclavian aneurysm of the third portion. He first ligated simultaneously the innominate and the common carotid and later the vertebral artery (1864). His ligation of the innominate artery is the first successful one in the world (1864). His patient survived, whereas Dr. Mott's (1818) did not. It was by ligating the vertebral artery on the appearance of secondary hemorrhage in his case that he cured the case.

Dr. Joseph Jones (New Orleans), 1833–1896, discovered the plasmodium of malarial fever before Laveran. (Statement of Professor Duval, of Tulane.)

Dr. Joseph Holt (New Orleans) was the first to force sulphurous acid gas into the hold of vessels for disinfection purposes. He disinfected them, but he did not know how or why. He was killing the mosquitoes, but did not know it until the mosquito discovery came to light.

Dr. Edmond Souchon (New Orleans) devised a new method to design colored charts for class demonstrations. The sketch is copied from a book with a pantograph, and the shading is done by black crayons and willow charcoal. The coloring is done with pastels. The drawing is made on book paper, the back of which is painted with thin Damar varnish and turpentine, which fixes the pastels and prevents its rubbing off. The paper is then pasted on large Bristol boards (30 x 40), and its surface is sized with thin gelatin and then varnished with thin Damar. Preservation of anatomical dissections with permanent color of muscles and organs by two methods. The chemical method using arsenic, calcium, chloride, and formol. The paint method, by which colorless muscles in a dissection are given permanent color by painting them with artists' paints. Founded preservative anatomy after the method described above. Founded methodic

anatomy as evidenced in a plea for methodical text-book on anatomy. A single and uniform guide is strictly followed in describing each and every organ, from the largest to the smallest. Founded philosophical anatomy as exemplified in the publication of philosophic anatomy of the tongue, liver, lungs, kidneys. The peculiarities only of the organs are considered, and it is endeavored to explain the reason of things, the why and wherefore. Founded esthetic anatomy by using systematically in teaching 400 large pastel colored charts and projecting on the screen a complete series of 300 colored lantern slides, the reproduction of the atlases of Bonamy and Beau and of Hirschfeldt and Leveille. Founded the Souchon Museum of Anatomy at Tulane University. It was so named by resolution of the Board of Administrators. It contains 350 dissections, large and small. They are all natural preparations. There are no dried, wax, or papier maché specimens. All the muscles and organs present permanent color. No other museum anywhere presents this feature. They are prepared after the Souchon method of preserving anatomical dissections. Surgical collateral branch, which takes the place of the main artery when that artery has been ligated. Embalming of bodies for teaching purposes. The chemicals used are arsenic, formol, alcohol, glycerin, carbolic acid, and creosote. The originality lies in the combinations selected, in the proportions of each and the result obtained in the color of the muscles. "First Complete History of Aneurysms of the Arch of the Aorta." "First Complete History of the Operative Treatment of Aneurysms of the Third Portion of the Subclavian Artery." "First and Only Dissection of a Subclavian Aneurysm of the Third Portion of the Subclavian Artery, Demonstrating the Collateral Circulation after Ligature of the Main Arteries." It took place through the anastomoses of the perforating intercostals with the branches of the subscapular in the substance of the great serrate muscle. The specimen is now in the Army Medical Museum in Washington. First to advocate simultaneous double ligature of the first portion of the subclavian and the vertebral artery without rupturing the coats for the cure of

subclavian aneurysm of the third portion. First to advocate the ligation of the axillary artery above the origin of the subscapular for the cure of recurrent aneurysm of the third portion of the subclavian. "First Complete History of Double Aneurysm of the Same Artery." "First Complete History of the Operative Treatment of Irreducible Dislocations of the Shoulder-joint." Resection of the head is better and easier than reduction. "Complete History of Drilling of Holes through the Skull to Explore with Syringe and Needle." "First Complete History of Wounds of the Large Surgical Veins." When a large vein has been injured and ligated, if the collateral venous circulation is inadequate and gangrene is threatened the main artery of the region must be ligated, but below the largest collateral which will carry enough blood to nourish the parts beyond, while the ligation of the main trunk will diminish the quantity of blood or equalize the arterial and the collateral venous circulation. "First Complete History of the Treatment of Abscesses of the Liver by Aspiration." Small abscesses of not over one quart were often cured by single aspiration. First to write a "Complete History of the Surgical Diseases and Injuries of the Neck." Each region of the neck is considered separately. The peculiarities only of diseases are mentioned. No generalities are mentioned. First to write a "Methodic Description of a Surgical Disease." A single uniform plan or guide is adopted and is strictly followed in describing each and every surgical disease. Devised "Souchon's Anesthetizer," an apparatus to inject anesthetic vapor in the lower pharynx by a rubber tube introduced through the nose or the mouth. The apparatus is worked by one hand which presses a bulb and forces the vapor through the tube. Its originality lies in its small size, and simplicity. Other apparatus used for this purpose are large, clumsy and worked with the foot and bellows. Devised speculum holder for Sims's duckbill speculum. An upright with a line of nails is screwed to the side of the operating table. The outside end of the speculum is held by a loop of rubber with a string to it. The string is wound around a nail on the upright. It is quite a help and relief

to the assistant who has only to guide the inside speculum in the proper position. "First Formal Plea for a Reform in Medical Education." "First Formal Plea for a Reform in University Education." Wrote the first "Formal Sanitary Code in America for the Louisiana State Board of Health." "Reminiscences of Dr. J. Marion Sims in Paris." Designed the "Floor Plans of the Josephine Hutchinson Memorial School of Medicine of Tulane University." It is the largest and most elaborate under-one-roof medical college in America. First to write a "Formal History of the Original Contributions of America to Medical Science to Date."

Dr. Rudolph Matas (New Orleans): "Drum Snares," solid rings for end-to-end and lateral intestinal anastomosis. "Method of Securing Circular Constriction with Fixation Pins of the Auricle to Obtain absolute hemostasis in operations for Cavernous and other angiomas of the auricle. Pins are inserted around the auricle and an elastic thread is wound around the pins. "Easy Method of Securing Hemostasis in Bleeding Injuries of the Upper Lip in Hemophilic Subjects." "Arrest of Hemorrhage by Direct Elastic Compression." An ordinary wide elastic band (stationers') is adjusted over the lip and fixed by threads to prevent slipping up or down. "New Methods of Reducing and Securing Fixation of Displaced Fragment in Zygomatic Fractures." A long semilunar Hagedorn needle threaded with silk is entered one inch above the middle of the displaced fragment, is passed well into the temporal fossa, and is made to emerge one-half inch below the arch. The silk is used to pull the bone into position. A firm pad is applied externally and the wire is twisted over the pad. On the ninth or tenth day the wire, pad, etc., are removed permanently. "Adaptation and Modification of the Kraske Method for Cases of Congenital Imperforation of the Anus." "Modification of the Fell-O'Dwyer Apparatus for Direct Intralaryngeal Insufflation (first Effort to Apply Positive Pressure in the Surgery of the Thorax in the United States) Anesthesia in Overcoming Surgical Pneumothorax." "A New Gradual Air Pump for Positive Pressure in its Applica-

tion to Medical and Surgical Practice." The Matas-Smyth pump. "An Adjustable Metallic Interdental Splint for the Treatment of Fracture of the Lower Jaw." "An Apparatus for Massive Infiltration Anesthesia with Weak Analgesic Solutions." Original methods of blocking the nerves in regional anesthesia: (1) "Original Method of Anesthesia of the Forearm and Hand by Intraneural and Paraneural Infiltration with Cocain, Novocain and Other Succedanea into the Trunks of the Musculospiral, Median, and Ulnar." The procedure secures complete analgesia of the forearm and hand, permitting amputations, resections, or any other operation. First case operated by this method, January, 1898. (2) "Regional Anesthesia of the Territory Supplied by Second Division of the Trigeminus by Blocking the Nerve from the Foramen Rotundum by Two Routes: (*a*) By Introducing the Needle through the Sphenomaxillary Fissure into the Sphenopalatine Fossa and Reaching the Nerve and Even the Gasserian Ganglion through the Foramen Rotundum." This route to the superior maxillary division of the trigeminus was first applied by Dr. Matas in removing both upper maxillæ for carcinoma April 29, 1899. This route is now known as the "Payr route" in Germany, though its application has only recently obtained in Germany. (*b*) The inframalar route to the second and third division appeared also at the same time (1899) to block the second and third division of the trigeminus for operations on the jaw, thus antedating Schlosser and now recognized as the "Matas route." (See Braun, *Local Anesthesia*, 2d ed., 1913; also Haertel, *loc. cit.*, 1913.) Original account of these and other procedures described by Dr. Matas. (See *Philadelphia Med. Jour.*, November 3, 1900.) Was also the first to apply spinal subarachnoid anesthesia for surgical purposes in the United States (November 10, 1899), though Leonard Corning, of New York, had applied it for medical purposes in 1886, and had laid the foundation for the surgical procedure. A. Bier, then of Keil, Germany, first introduced and resorted to it for surgical purposes in April, 1899. (See *Philadelphia Med. Jour.*, November 3, 1900). "An operation for the Radical Cure of Aneu-

rysm by Endo-aneurysmorrhaphy, with Intrasaccular Suture (the 'Matas operation'), First Applied in March, 1888." In this three different methods are described for the first time: (1) obliterative, (2) restorative, (3) reconstructive endoaneurysmorrhaphy; 225 operations by these methods were reported up to August 17, 1913. International Congress of Medicine, London. "The Flexible, Flat, Removable Band for the Occlusion of Large Surgical Arteries (with Dr. Carroll W. Allen), the "Matas-Allen band," for testing the efficiency of the collateral circulation in the circle of Willis and other parts (a modification of the Halsted band). "A Method of Testing the Efficiency of the Collateral Circulation as a Preliminary to the Occlusion of the Great Surgical Arteries, Hyperemia Reaction or Living Color Test (Used on the Extremities):" Complete ischemia of the limb is obtained by elevation and application of an elastic bandage to the level of the lesion. Then a Matas compressor is applied to the proximal side and as near the aneurysm as possible until the aneurysm is absolutely stilled and is allowed to remain from six to ten minutes. Immediately on removal of the elastic bandage, the compressor being still in place, a hypodermic flush descends the limb rapidly. The digits retain a cadaveric, waxy, lifeless pallor for several seconds, which may be prolonged from ten to forty minutes, or even longer, according to the development of the collaterals. If there is no collateral circulation the limb will remain ischemic. The second test is based on the preliminary occlusion of the main artery, with the pliable and removable aluminum band, which can be removed in fifty-six hours without injury to the vessel in the event of manifestations of ischemic phenomena; for example, hemiplegia, stupor, and coma after the obliteration of the common carotid artery. "A Method for Reducing the Caliber of the Thoracic Aorta by Plication or Infolding of its Walls by Means of Lateral Parietal Suture Applied in One or More Stages." (An experimental investigation with Dr. Carroll W. Allen). "Direct Duodenal Catheterization through the Gall-bladder and Common Duct for Nutrient Medicinal Purposes" (an Extension of McArthur's

Gall-bladder Drip). "A Simple Expedient in Treating Complicated Fractures of the Lower Jaw in Conditions Forbidding the Use of Splints or Intrabuccal Prosthesis" (with Dr. L. Landry). Four or five turns of a thin Esmarch bandage are taken around the face and jaw from the bregma to the chin and under the jaw; this is fixed by a bandage passed around the forehead to prevent slipping. Immobilizes the fragments after reduction; assists materially in getting rid of swelling and edema. "The Prophylaxis of Postoperative Tetanus Based upon Proper Dietetic Measures and upon the Contamination of the Alimentary Canal, with the Tetanus Bacillus Introduced in Uncooked Vegetable Foods." Dr. Matas has devised a special rachitome which he uses with advantage in performing laminectomy for extensive spinal lesions. This is a simple but very strong chisel, with a short but powerful cutting tooth prolonged into a long curved, metallic handle. The chisel has enormous strength and leverage, and can cut a continuous linear section through the laminæ in a very short time without injury to the dura. Dr. Matas has also devised and uses with advantage a special long suture carrier which greatly facilitates the tacking of the omentum or mesentery in making colonic or other visceral suspensions for prolapsed stomach, colon, etc. It permits of an extensive suturing of distant displaced organs through a comparatively small median incision. In this way a colonic suspension may be made in the course of a pelvic operation through a short and low laparotomy incision with little additional trauma or intraperitoneal manipulation. In an exhaustive monograph on the "Surgical Treatment of Anorectal Imperforation" (congenital) Dr. Matas laid special stress upon the advantages of the perineococcygeal route and described a procedure which he first applied with decided success in a case of imperforate anus with a high-placed enteron. In this case the distended gut was brought down from a high position in the pelvis by a partial Kraske, which allowed it to be pulled down to the proctodeum or infundibulum, to which it was sutured by a lateral anastomosis. In this way the sphincter fibers of the anal region are preserved and a better chance of

rectal control is obtained. Matas says that: "My effort to simplify the cure of aneurysm by the intrasaccular suture and the principles involved in the modern treatment of aneurysms and my insistence upon the surety of studying the conditions of the collateral and peripheral circulations before attempting the permanent occlusion of the great surgical arteries, and my insistence also upon the simple and efficient method which I have devised and practised, and by which the efficiency or inefficiency of the collateral circulation can be determined, are the contributions which I would prefer to have recognized."

Dr. Arthur W. De Roaldes was the first to establish a nose, eye, ear, and throat hospital in the South from the Atlantic to the Pacific and from St. Louis to the Gulf.

Drs. F. W. Parham and E. D. Martin devised a new treatment for fractures. It consists in a band that fits snugly around any unevenness of the bones. Especially useful in the treatment of oblique fractures.

Dr. Charles W. Duval (New Orleans) claims to be the first to obtain the bacillus of leprosy in pure culture. Subcutaneous leprous nodules are removed under sterile conditions, cut into small bits and planted aërobically on a medium of split protein products. After removal it is autolyzed by adding some proteolytic bacterium or allowing the tissue to slowly disintegrate under sterile conditions at 37° C. for several weeks, then extracting the juice by Berkefeld filtration. Dr. Duval has discovered the causal agent of infantile diarrhea or summer complaint, and proved that it is a bacillus belonging to the dysentery group.

Dr. Wm. H. Harris (New Orleans): "Production of Pellagra in the Monkey by a Berkefeld Filtrate from Human Lesions." The filtrate was injected hypodermically.

Dr. Maurice Couret (New Orleans) demonstrated that the fish is the host of the bacillus of leprosy. The fish were inoculated simultaneously with a bacterial emulsion of Bacillus lepræ. Fish were fed on human leprosy nodules and the flesh of infected fish. All the bacilli multiplied in the fish and were harbored by them without apparent discomfort or outward evidence of the disease.

Dr. C. C. Bass and F. M. Johns (New Orleans) were the first to cultivate the plasmodium of malarial fever (1911). They showed that when blood with plasmodium was heated to a certain temperature the plasmodium continued to live for a certain time but would eventually die. By adding some dextrose the plasmodium continued to live and multiplied. They have studied especially the influence of emetine and ipecac as a specific remedy against the protozoön of pyorrhea alveolaris, specially proper dose, best method of administration, duration of treatment, and prevention of relapse or reinfection.

Dr. Marion Souchon (New Orleans) was the first to remove a urinary calculus from the vesical portion of the ureter through the perineal route. He was guided by the touch through the rectum and through the wound.

Dr. Robert Clyde Lynch (New Orleans) claims to be the first to remove a tumor whole from the larynx. Also to be the first to have sutured a surgical wound in the interior of the larynx.

Mr. Lloyd Arnold (New Orleans) is the first to demonstrate the occurrence in the human ovary of several ova in the same follicle. The work was done under the direction of Professor Irving Hardesty in the laboratory of anatomy at Tulane University.

Dr. Carrol W. Allen (New Orleans) is the first to publish the only thorough book on local anesthesia in the English language.

Dr. Ansel Caine (New Orleans) devised a warm ether apparatus without using a flame. The apparatus consists of a bellows worked by foot pressure which vaporizes the ether. The vapor is driven through a coil of pipe enclosed in a metal receptacle containing acetate of soda. This receptacle is immersed in boiling water for fifteen minutes before using and the soda will retain the heat for several hours. The vapor driven through the heated coil is delivered warm to the patient.

Dr. Henry D. Burns (New Orleans) was the first to devise a tucking operation for shortening any one of the straight muscles of the eye.

Dr. Oscar Dowling was the first in the Southwest to equip a health car for the Louisiana State Board of Health and with it to travel over the country to perform the true functions of a State Board of Health, *i. e.*, to teach the people how to preserve and improve their health.

Dr. Stanford C. Jamison, by experimenting on dogs, discovered that when the large vessels of the spleen were ligated the organ would not slough if it were covered by the omentum.

The State of Louisiana was the first State to establish and maintain a leprosarium (Leper's home).

MARYLAND

Dr. John B. Davidge (Baltimore), 1768–1829, first tied the gluteal artery for aneurysm.

Dr. Horatio G. Jameson (Baltimore), 1778–1855, was the first to describe animal ligature in 1827. He was the first in this country to remove the upper jaw (1820). Was the first to proclaim non-contagiousness of yellow fever. He was the first to incise the cervix uteri.

Dr. Ruben D. Mussey (Baltimore?), 1780–1866: Was the first to ligate the two common carotids after an interval of but twelve days (1831–37).

Dr. William Gibson (Baltimore), 1788–1868, ligated the common iliac for the first time in the history of surgery (1812).

Dr. John D. Goodman (Annapolis), 1794–1830, produced three works of importance and originality; his treatise on the fascia, his contribution to physiological and pathological anatomy and his American natural history.

Dr. John R. Young (Baltimore), published, in 1803, the first American contribution to the physiology of digestion. He demonstrated that the solvent principle of the gastric juice is an acid which is a part of the normal gastric secretion.

Dr. Charles Frick (Baltimore), 1823–1860, was the first to show that the mere presence of albumin does not itself indicate organic disease.

Dr. Edward Warren (Baltimore), in 1871, first resected the head of the humerus in the case of an old, irreducible dislocation.

Dr. W. K. Brooks: Work in embryology.

Dr. William S. Halsted (Baltimore, Johns Hopkins): 1880–1881, introduced gutta-percha tissue as a dressing for granulating and fresh wounds, employing it later as a drainage material. Was the first to use silver-foil, rubber gloves, and gutta-percha tissue. The thin gutta-percha was first made at his request. 1884, directed attention to the effects of abduction and adduction on apparent length of limb and on measurements in fracture of the neck of the femur. 1884, performed and recommended transfusion of blood centripetally into an artery in the human subject and returned by transfusion the patient's own blood after it had been mechanically freed of the poison (CO) of illuminating gas. 1885, devised and described the distention or infiltration method of employing cocain for local anesthesia; noted also that the injection of cocain into a nerve produced anesthesia in the parts supplied by that nerve, and that cutting off or diminishing the blood supply of the cocainized part increased and prolonged the anesthetic effect. 1885, discovered that local anesthesia might be produced by the injection of exceedingly weak solutions of cocain and even of water. 1886, recommended and practised the treatment of urethritis by irrigation with antiseptic solutions. 1887, directed the attention of surgeons to the submucous coat of the intestines and to the necessity of including a portion of this coat in the stitches in making an intestinal suture. Performed on animals operations of reversal of the intestines and the isolation of an intestinal loop. 1888, made the discovery, with Sir Victor Horsley and independently, that after removal of a portion of the thyroid glands in dogs there occurs a characteristic hyperplasia of the part remaining and that the glands of puppies of thyroidectomized parents became likewise hypertrophied. 1889, devised the buried plate-and-screw method for the treatment of fractures. 1889, introduced the teaching of operative surgery on animals.

1889–1894, described a radical operation for the cure of cancer of the breast. 1890, introduced rubber gloves. 1891–1893, devised an operation for the cure of inguinal hernia. 1891, performed the first successful ligation of the first portion of the left subclavian artery, also the first and for many years the only excision of a subclavian aneurysm. 1895, devised a method of skin transplantation by progressive rotation of the transferred pieces. 1896, performed the first excision of a cancer of the diverticulum of Vater of the common duct. 1896, introduced silver-foil as a dressing for closed wounds, covering for skin grafts, etc. 1901, discovered, with Opie, in a case of acute hemorrhagic pancreatitis that retrojection of bile into the pancreatic duct might be a cause of this lesion. 1903, recommended the use of the cremaster muscle in the treatment of the oblique form and the sheath of the muscular rectus abdominis in the direct form of inguinal hernia. 1905, devised a method for the partial, progressive, and complète occlusion of the aorta and other large arteries by the use of metal bands, also an instrument with which to curl and apply these bands. Introduced the metal roll or band and was the first to experiment with the partial occlusion of arteries. 1906, operated upon the aortic arch in the human subject and (1906) upon the thoracic artery in animals and man, and demonstrated that after partial occlusion of the aorta (thoracic) the systolic blood-pressure might remain lowered for months. 1906, cured aneurysm of some of the principal arterial trunks by partial occlusion of the artery proximal to the aneurysm. 1906–1908, demonstrated on dogs the possibility of the transplantation of the parathyroid glands and obtained absolute proof of a vital function of these epithelial bodies. Established certain laws relative to the transplantation of the parathyroid glands. 1906, treated tetany successfully by the administration of the parathyroid glands of beeves. 1906 or 1907, made use of measurements of the mammary radii to assist in the diagnosis of breast tumors and in the determination of the age and relative malignancy of cancer of the breast. 1910, contrived, with Dr. Willis D. Gatch, the obturator or bulk-

head method of performing end-to-end suture of the intestines. "The Transfixion Method of Controlling Hemorrhage with the finest silk embraces features and principles which are original (1913)." "An Original Method of Closing the Wound in Operations for Cancer of the Breast, Obliterating the Dead Space under the Clavicle." The swelling of the arm and restriction of motion is prevented by this method (1913). 1914, employed the partial occlusion of the external iliac artery as a preliminary to excision of an iliofemoral aneurysm. Demonstrated the beneficial effect of radiation of the thymus gland in cases of Graves's disease uncured by double lobectomy. Demonstrated that a parathyroid graft too small to be visible to the naked eye was sufficient to maintain the life of a dog (1912). First to transplant the parathyroid glands in dogs. Established the law that for the successful transplantation of these bodies a deficiency must be created. These experiments furnished the first functional proof of the vital importance of these organs in dogs, that tetany would follow the removal of the sustaining graft. Report first cases of open-air treatment of surgical tuberculosis. Also instituted the outdoor treatment of general surgical patients.

Dr. W. H. Welch has specially advanced bacteriology and pathology in America. He discovered the Staphylococcus epidermidis albus and its relation to dermal infection (1892); also the Bacillus aërogenes capsulatus (1892); in important studies of embolism and thrombosis, with Flexner, he demonstrated the pathological changes produced by experimental injection of the toxins of diphtheria, simultaneously with Von Behring. He is the high priest educator of the Johns Hopkins shrine. He has contributed a number of able and distinguished pupils to the medical sciences. Dr. Welch has contributed more than any one man to the foundation of the great Johns Hopkins Medical School.

Dr. William Osler (Baltimore) is also a great educator and leader of men and thought. He has also contributed to the glory of Johns Hopkins.

Dr. Howard Kelly (Baltimore) is well known as an operator and teacher. His example and success in gynecology have greatly

contributed to the advancement of gynecology in America and make him the standard-bearer of gynecology in this Western Hemisphere (if not in both). He has also contributed in building up the fame of Johns Hopkins.

Dr. William S. Thayer (Baltimore), Johns Hopkins: "First Instances of Gonorrheal Endocarditis in which gonococci were obtained in the circulating blood during life (1896)." "Description for the First Time of the Existence of the Third Heart Sound" (in collaboration with Dr. MacCallum (1908). "The Ameboid Activity of Megaloblasts."

Dr. Charles W. Byrnes (Baltimore): "A Study of the Axis-cylinders in Five Cases of Glioma Cerebri." This is the first piece of work in which it has been demonstrated that the not infrequent absence of clinical symptoms in even large cerebral tumors of this type can be accounted for by the fact, that although the myelin sheath may be destroyed, numerous healthy axis-cylinders can be observed passing uninterruptedly through the midst of a large gliomatous mass. My contribution has been referred to by Sir William Osler in his *System of Medicine*, vol. vii, first edition. "The Intradural Administration of Mercurialized Serum in the Treatment of Cerebrospinal Syphilis." Although mercury has been previously used intradurally, this is the first paper in which this particular form of mercury administered in serum has been recorded. In other words a new method of administration has been introduced.

Dr. Harvey Cushing (Baltimore, Johns Hopkins) has done much original work in experimental physiology, pathology, and surgery such as the experimental production of gall-stones, experimental production of valvular heart lesions in the dog, successful treatment of paralysis of the face in man by anastomosis of the spinal accessory and facial nerves. He has introduced nerve-blocking, a special suture, lumbar drainage in hydrocephalus, crow-bar incision in opening the base of the brain. He has developed decompression operation, particularly in intracranial hemorrhages in the newborn and inaccessible tumors. He has thrown much light on the physiological actions of the

pituitary body by experiments and by the general consideration of its disorders as "dyspituitarism."

Dr. Thomas S. Cullen (Baltimore) discovered the true source of adenomyomata in the Müllerian organ. He also made the fullest investigation of fibroid tumors, hydrosalpynx, and omental disease.

Dr. Llewellys F. Barker (Baltimore) described, in 1896, a unique case of circumscribed unilateral and elective sensory paralysis; also eye signs in nephritis; work in pharmacodynamics; new book on *Diagnosis*.

Dr. Wm. G. MacCallum (Baltimore) and E. L. Opie (1897) demonstrated the sexual conjugation in malarial parasites.

Dr. J. M. T. Finney (Baltimore) has contributed considerably to the foundation of the American College of Surgeons, of which he is the first distinguished and efficient President.

Dr. William H. Howell (Baltimore) wrote the best treatise on physiology and did important work on the life history of blood corpuscles (1890) and on antithrombia and thromboplastia (1911).

Professor John J. Abel (Baltimore, Johns Hopkins): 1892, discovered that carbamates are present in the urine of children, as well as in that of dogs, after the administration of lime water in excess. 1894, discovered that ethyl sulphide, $(C_2H_5)_2S$, is a normal constituent of dog's urine. 1896, was the first to isolate the dark pigments of the negro's skin and hair and to make chemical analysis of these substances. 1897–1905, in 1897, assisted by Dr. A. C. Crawford, Professor Abel described his method of isolating the active principles of the suprarenal capsules. He was the first to isolate this principle in the form of monobenzoyl salts. 1907, assisted by W. W. Ford, Professor Abel demonstrated that the hemolytic constituent of the poisonous fungus, Amanita phalloides, is a very unstable glucoside and not toxalbumin, as Kobert and others had supposed. 1909, with L. G. Rowntree, the pharmacological properties of a number of substituted phthaleins, notably phenolsulphonephthalein and tetrachlorphenolphthalein, were first carefully investigated. 1910,

discovered and first prepared the compound, ethyl antimony thioglycocollate. 1910, discovered that acid fuchsin causes "late" convulsions in frogs and that removal of the anterior third of the brain greatly increases the toxicity of the drug for these animals. 1911, discovered that epinephrin is a constituent of the venomous secretion of the skin glands of the giant tropical toad, Bufo agua. 1912–1913, devised the process known as "vividiffusion." Essentially the process consists in passing the blood which has been made inoculable (by injection of hirudin) from a cannula connected to an artery or a vein through a series of tubes made of celloidin or other suitable or artificial serum and back by another cannula into a vein of the same animal. 1914, plasmapheresis: reflecting on the drawbacks of venesection, which limits the use of this procedure in practical medicine, Professor Abel conceived the idea that the main objections to blood-letting could be obviated by the speedy return into the body of the red and white corpuscles instead of throwing them away as has hitherto been the custom. Evidently the only thing that could be removed from the blood of a person bled in this way would be its fluid part—the plasma.

Drs. L. G. Rowntree and Geraghty: Phenophthalein test in renal disease.

Dr. Thomas C. Gilchrist (Baltimore) first described blastomycosis (1896).

The Johns Hopkins Hospital is one of the greatest contributions of its kind in America.

The Johns Hopkins School of Medicine was the first to have whole-time professors for the clinical branches.

MASSACHUSETTS

Dr. John Warren (Boston), 1753–1815, was the first to amputate at the shoulder-joint (1781) and to excise the parotid gland (1804). He founded the Harvard Medical School.

Dr. James Jackson, Sr. (Boston), 1777, published one of the earliest accounts of alcoholic nephritis which he described as arthrodynia á potu (1822).

Dr. John Collins Warren (Boston), 1778–1856, the founder of the Warren Museum. He was the first in this country to remove a large fibroid polypus from the base of the cranium through the hard and soft palates. He was the first in this country to perform staphylorraphy (1828). He was the first in the world to perform paracentesis. He was the first in this country to excise the hyoid bone (1804), to perform osteoclasis, to excise the head of the humerus, and external urethrotomy. He was in his sixty-ninth year when he first operated under ether in 1846, administered by Morton. He first excised the elbow-joint (1834). He was the first in this country to operate for strangulated hernia.

Dr. N. C. Keep (Boston) first used chloroform in childbed in this country. Dr. Channing (1786–1876) followed him by one month.

Dr. Jacob Bigelow (Boston), 1787–1879, was one of the first to describe that self-limitation is a law that governs many diseases (1835). First described paraphyblum.

Dr. John Ware (Boston), 1795–1864, was one of the first to recognize the characteristics of croup by the presence of a false membrane in the air passages (1842). He first proved that the expectant treatment is the best for delirium tremens (1831); that it is a self-limited disease.

Dr. John D. Fischer (Boston), 1797–1850, invented the cystoscope.

Dr. Oliver Wendell Holmes (Boston), 1809–1894, was the first to discover the cause and spread of puerperal fever (1843), not Semmelweiss. He was the first American physician to write a novel. He contributed the words anesthesia and anesthetic.

Dr. James Jackson, Jr. (Boston), 1810–34, first described the prolonged expiratory sound as an important diagnostic sign of incipient phthisis (1833).

Dr. Morrill Wyman (Cambridge), 1812–1903, was the first to tap the chest with a trocar and cannula with a suction pump attached. He observed that the only treatment of hay fever is to go to a place free from it.

Dr. Horace Wells (Boston), 1815–1848, was a dentist. He had a tooth drawn under anesthesia by Dr. Riggs when he lived in Hartford, where he was born. He was the first to use nitrous oxide for extracting teeth, but with irregular success because he did not use a sufficient volume of gas (Bigelow).

Dr. Charles Jackson, 1815–1848, suggested to Morton to use ether instead of nitrous oxide. He was a chemist. Wells and Morton boarded at his house.

Dr. Wm. F. Morton (Boston), 1819–1868, was a dentist. He was the first who used ether for a surgical operation performed by Dr. John Collins Warren at the Massachusetts General Hospital in 1846. The case of Morton was the first public case and the first published. It was given world-wide notoriety by Bigelow, Holmes and Warren.

Dr. Henry J. Bigelow, 1818–1890, first demonstrated the importance of a Y-ligament in the reduction of dislocation of the hip-joint (1869). He introduced the operation of litholapaxy (1878). He was the first in this country to excise the hip-joint (1852).

Dr. Henry P. Bowditch (Boston), 1840–1911, first investigated Treppe in heart muscle (1871); showed that isolated heart apex will beat in delphine (1871). He first demonstrated the indefatigability of nerves (1890), which idea led in time to the anesthetic blocking of nerves. He was the first to perform thoracentesis in America.

Dr. Jonathan Wright (Boston), in 1847, first treated aneurysm by compression.

Dr. Franklin H. Hooper (Boston), 1850–1892, contributed valuable experiments on the innervation of the larynx, with special reference to the functions of the recurrent laryngeal nerve. He introduced in America the McKenzie method of removing hypertrophied adenoids from the pharynx under general anesthesia.

Dr. Charles S. Minot (Boston), 1852–1914, published a treatise on *Human Embryology*, which introduces many novel theories. He invented two different kinds of automatic micro-

tomes. He made original investigation on the origin and structure of the placenta. His *Age, Growth and Death* state the law of cytomorphism, in virtue of which these processes result from the steady change of protoplasm into more highly differentiated forms.

Dr. Humphrey David Storer (Boston), (1832), first removed the uterus for fibroids.

Dr. James Lloyd (Boston) (deceased, no dates) was the first to systematically begin the practice of midwifery.

Dr. J. P. Maynard (Boston) (deceased, no dates) introduced collodion as a surgical dressing.

Dr. Henry O. Marcy (Boston) introduced Listerism in America. Devised buried absorbable animal suture. Has contributed considerably and efficiently to the cure of hernia. Was the first surgeon in America to deliberately operate for biliary obstruction. He introduced antiseptic ligation in the radical cure of hernia (1878). He wrote important treatises on hernia and the surgery of the perineum. He probably antedated all others in the use of modern successful methods in the cure of reducible hernia.

Dr. Theobald Smith (Boston) has been one of the pioneers in the theory of infectious diseases. He demonstrated, in 1886, with Dr. E. Salmon that immunity from hog cholera could be secured by injection of the filtered products of the specific organism. This was the first experiment in immunization. He and Dr. F. L. Kilborne discovered the parasite of tick fever (1893). He demonstrated anaphylaxis from the bacterial products of diphtheria prior to 1903, a discovery which Dr. Ehrlich called the Theobald Smith phenomenon. First made clear differentiation between bovine and human types of tubercle bacilli in 1898. He was the first to make the discovery of pleomorphism in bacteria.

Dr. W. T. Councilman (Boston): The work on *Malaria* was pioneer work in this country. "The First Recognition of the Cerebral Changes in Pernicious Malarial Fever." "The Subsequent Descriptions of Organisms was Secondary to the French and Italian Work." "Arteriosclerosis: The Recognition of this Condition as a Disease Affecting all Tissues." "Amebic Dysen-

tery: the first description of this as a specific disease with the differentiation from other forms (1890–91)." "Recognition of Acute Interstitial Non-suppurative Nephritis as a Definite Type of Renal Disease." "Study of Diphtheria: Some Anatomical Lesions not Hitherto Described." "Relations of Organisms to Lesions More Closely Studied." "Cerebrospinal Meningitis. Study of Epidemic in Boston," published by State Board of Health. "The First Thorough Study of Disease, with Reference to Action of Organism, etc." "Small-pox Studies. Lesions; Relation of Vaccinia Variola Inoculata and Variola Vera; description of Supposed Organism, with Numerous Co-workers."

Dr. R. C. Cabot (Boston) is the originator of the Massachusetts General Hospital autopsy sheets sent to physicians who apply for them.

Dr. Reid Hunt (Boston): There are two types of reflex fall of blood-pressure: one probably due to an inhibition of the vasoconstrictor center and another to a stimulation of vasodilator centers. Showed that, contrary to the prevailing views at that time, the accelerator nerves to the heart are in a condition of tonic activity, and that this is an important factor in maintaining the normal heart rate; that the accelerator and inhibitory nerves are true antagonists; that the most important factor in reflex acceleration of the heart, and probably in many other forms of rapid heart action, is a diminution of the tonic activity of the cardio-inhibitory nerves. Isolated cholin from the suprarenal gland and showed that it is the cause of the fall of blood-pressure caused by the injection of extracts of this gland (after removal of the epinephrin).

Dr. W. B. Cannon (Boston) says that the method of observing the movements of the stomach and intestines by means of *x*-rays, after a meal containing bismuth salt had been given was first employed in the laboratory of physiology of the Harvard Medical School (1898).

Dr. E. Cutter and Mr. G. B. Clark (Cambridge) devised a laryngoscope with two tubes, one for observation and the other for illumination.

Dr. E. E. Foster (New Bedford) was the first, so far as I know, to confirm, by intranasal measurements, the statement often made by orthodontists, that widening of the palatal arch widens the nasal cavities.

Drs. Bradford H. Osgood, J. E. Goldthwaite, Edville G. Abbott and Robert W. Lovett have done fine orthopedic work.

The Warren Museum of Anatomy was the first museum of the kind founded in America.

Boston has contributed the finest medical buildings in the world, those of the Harvard School of Medicine.

MICHIGAN

Dr. Henry S. Cheever (Ann Arbor), 1837–1877. His graduation thesis on "Catalysis" was based on his own experiments and brought out points not previously made.

Dr. F. G. Novy (Ann Arbor) discovered trypanosome of American variety of relapsing fever (1907).

MINNESOTA

Dr. William J. Mayo (Rochester): "Complete Section of the Vas Deferens: End-to-end Union by a Simple Method, Which Might Be Applied to a Divided Ureter," January, 1895. This method of union over a thread is now generally practised. "Further Experience with the Vertical Overlapping Operation for the Radical Cure of Umbilical Hernia," July, 1903. This method is generally accepted at the present time for the radical cure of umbilical hernia. "The Ileocecal Orifice and its Bearing on Chronic Constipation, with Report of Two Cases Relieved by Operation," March, 1900. Introduced the subject of intestinal stasis. "Some Observations on the Surgery of the Common Duct of the Liver," April, 1904. Originated cholecystectomy from below up, the method now generally practised. "Acquired Diverticulitis of the Large Intestines" (W. J. Mayo, L. B. Wilson and H. Z. Giffin), July, 1907. Introduces this

important disease. Greatest credit due to Wilson, who readily discovered the pathology in excised specimens of tumors of sigmoid. "Contributions of Surgery to a Better Understanding of Gastric and Duodenal Ulcers," May, 1907. Introduces pyloric vessels in relation to the location of the pylorus. Important in relation to differentiating ulcers of the stomach and duodenum. "Anemic Spot on the Duodenum Which May be Mistaken for Ulcer," June, 1908. "A Review of 500 Cases of Gastroenterostomy, Including Pyloroplasty, Gastroduodenostomy, and Gastrojejunostomy," July, 1905. Introduces technic of gastroenterostomy, no-loop method to left. "Method of Anastomosis between Sigmoid and Rectum," October, 1909. "The Radical Operation for the Relief of Cancer of the Rectum and Rectosigmoid," May, 1912. Tube method of union following resection. Generally adopted method. "The Fatty Fascial Flap in Plastic and Other Operations on the Pelvis of the Kidney," April, 1910. Very important and now accepted. "Gastrojejunal Ulcers (Pseudojejunal Ulcers)," March, 1911. Important in connection with the cause of recurrence of ulcer symptoms after gastroenterostomy and showing the suture ulcer defect of the operation and the necessity of discontinuing the continuous silk or linen suture for the interrupted suture. "Transgastric Excision of Calloused Ulcer of the Posterior Wall of the Body of the Stomach," December, 1910. Generally adopted. "Suprapubic Transcystic Removal of Calculi Impacted in the Portion of the Ureter Which is Situated in the Wall of the Bladder." June, 1911. "The Incision for Lumbar Exposure of the Kidney," January, 1912. Generally adopted. "Nephrectomy without Drainage for Tuberculous Kidney," November, 1912. "Pathological Data Obtained from Ulcers Excised from the Anterior Wall of the Duodenum," May, 1913. Showing the nature of the duodenal lesion. "Accidental Injuries to the Descending Portion of the Duodenum during Removal of the Right Kidney," January, 1914. "Localized Tuberculosis of the Intestine; Report of Seven Cases Operated on," February, 1899. Attributes surgical tuberculosis to cow's milk. "Sur-

gical Tuberculosis in the Abdominal Cavity, with Special Reference to Tuberculous Peritonitis," April, 1905. Demonstrating the Fallopian tubes as being the most frequent cause of tuberculous peritonitis in women. "Study of 534 Operations upon the Gall-bladder and Bile Passages, with Tabulated Report of 547 Operated Cases," May, 1903. Contributing to the progress of surgery of the gall-bladder and bile ducts. "Some Observations on Cases Involving Operative Loss of Continuity of the Common Bile Duct with the Report of a Case of Anastomosis between the Hepatic Duct and the Duodenum," July, 1905. First Report of successful anastomosis of hepatic duct of duodenum. "Radical Operations for the Cure of Cancer of the Pyloric End of the Stomach," March, 1904. Introduction of a modern technic for the radical operation. "Duodenal Ulcer: A Clinical Review of 58 Operated Cases, with some Remarks on Gastrojejunostomy," December, 1904. Demonstrating the frequency of duodenal ulcer and introduction of the subject of chronic duodenal ulcer. "Chronic Ulcer of the Stomach and First Portion of the Duodenum, with Special Reference to the Surgical Treatment," July, 1905. "The Surgical Treatment of Gastric and Duodenal Ulcer and its Results." June, 1906. "A Study of Gastric and Duodenal Ulcers, with Special Reference to Their Surgical Cure," June, 1908. Introduces the whole question of the now accepted surgical understanding of chronic peptic ulcer. "Surgery of the Large Intestine, with a Review of 100 Resections," July, 1909. Technic of resection of colon. Important as contributing to ease and safety of these operations. "Resection of the First Portion of the Large Intestine and the Resulting Effect on its Function," June, 1914. "Mesocolic or Retrogastric Hernia," April, 1909. "Surgical Treatment of Prolapse of the Uterus and Walls of the Vagina," October, 1912. Vaginopelvic fixation for prolapsus uteri.

The Mayo Brothers have contributed the Mayo Clinic Foundation, a unique instance.

Dr. Charles H. Mayo (Rochester, Minn.). (1) "Septic Diseases of Knee-joint; Open Treatment by Division of Patella,

Resuturing and Securing Motion." (2) "Varicose Veins of the Lower Extremity; Subcutaneous Stripping; Special Instruments." (3) "Heat in Surgery; Methods of Puncture of Nevi and Treatment of Cauliflower Cancer of the Uterus." (4) "Hypospadias; Making New Urethra from Prepuce, Tunneling Method." (5) "The Technic of Shortening the Round Ligaments; Shortening Round Ligaments, Combined External and Internal Method." (6) "Peripheral Versus Intracranial Operations for Tic Douloureux; Plugging of Foramen with Silver Screw or Lead Plug, External Operations." (7) "Treatment of the Posterior Capsule of the Gland in Thyroidectomy; Based on 374 Operations for Goitre; Benefits of Preservation of Posterior Capsule of Thyroid." (8) "Transperitoneal Removal of Tumors of the Bladder; Transperitoneal Removal, Obvious Benefits of Method for Radical Procedures." (9) "The Surgical Treatment of Bunion; Bunion Bursa Turned Over Cut Surfaces of Bone, Preserving Motion." (10) "Diagnosis and Surgical Treatment of Esophageal Diverticula; Two-stage Method of Removal of Large Esophageal Diverticulum." (11) "Extirpation of Tumors of Vomer through the Roof of the Mouth; Method of Approach Tumors of the Vomer through Hard Palate, with Preservation of Soft Palate." (12) "Factors of Safety in Intestinal Surgery; Methods of Suture, Provision for Temporary Secondary Gas Drainage." (13) "Cholecystitis and the Factors that Control Results of Operation; Transplanting of Fat to Prevent Adhesions of Stomach and Bowel to Liver." (14) "The Preparation of Dry Bony Areas for Skin Grafting; Production of Granulations through Multiple Drill Holes through Outer Plate into Diploë." (15) "Uterine Prolapse with Associated Pelvic Relaxation; Method of Building Pelvic Floor from United Broad Ligaments so Sutured as to Support Bladder." (16) "Errors in Anatomical Development, their Cause and Surgical Significance: New Deductions as to Causation."

Dr. J. P. Sedgwitch (Minneapolis): The study of von Graefe's sign in myotonia congenita is the only report that I know of familial appearance in this disease. "The Study of Creatinin

and Creatin Metabolism in Children" contains first analysis of the creatinin and creatin excretion for the first week of life and contains the first statement in regard to the high creatinin and creatin exertion in recurrent vomiting. The study on "Relationship of Gastric to Pancreatic Fat Digestion in Infants" is, as far as I am able to find, the first and only discussion that has been made of that subject, except that by Davidson, which appeared two years later in the *Zeitschrift f. Kinderheilkunde* and was carried on by physical chemistry methods. "The Study of Recurrent or Periodical Vomiting" contains confirmatory analysis of my earlier work, and puts forth a new view in the relation of adenoids to recurrent vomiting. The study on "Maternal Feeding" presents the results from the reports of 3000 physicians. It is the only paper discussing this matter from this stand-point in English, and, I believe, the only study of this character, except a very short study by Rietschel, of a few children of German pediatrists. "The Complement-Fixation Reaction of the Blood of Children and Infants, Using the Bacillus Abortus as Antigen," is, I believe, the only study that has been made upon the subject as yet. The work on *Spasmophilia, with Special Reference to Familial Reactions and Repeated Absences*, contains a new and original study of that subject.

Dr. Oscar Breitenbach (Frazee, Minn.): Winter cholera has no specific bacteriological pathology, and is a synonym in nature occurring in cold weather. Meteorological conditions do not prove to be the exciting cause in these epidemics.

MISSISSIPPI

Dr. J. M. White (Meridian), "New Operation for Appendicitis." The point claimed as new and never been done before is making two flaps of these appendicular stumps so they can be coapted, walling off the flaps with a second fine through and through catgut suture so that the different layers of tissues can heal by first intention.

MISSOURI

Dr. Victor C. Vaughn (Mount Aisez, Mo.), 1851, did important work on ptomains and leukomains, cellular toxins, protein split products; discovered bacillus in poisonous ice cream and cheese (1896).

Dr. John Green (St. Louis) is the first to find that hemetropia caused ocular or systemic disease (statement of Dr. J. H. Thorpe, of Owensberg, Ky.). He introduced the test cards in ophthalmology.

Dr. L. Rosenwald (Kansas City) reported the first case of complete cleft of the glans penis.

Dr. Ecklesheimer and Schoemacher (St. Louis) are the first to publish a complete cross-section anatomy (1911).

NEBRASKA

Dr. C. C. Johnson (Creighton) claims priority in the advancement and execution of the teaching of infectious diseases and sanitation in the public schools.

Dr. Williams F. Milvoy (Omaha) first described persistent edema of the legs, or Milvoy's disease (1892).

NEW HAMPSHIRE

Dr. Amos Twitchell, 1781–1850, first ligated the common carotid in continuity for secondary hemorrhage (1807). In 1838 he removed successfully the arm and the clavicle for malignant disease. In 1840 he had diagnosed and operated upon 3 cases of suppuration in the medullary canal. He performed several ovariotomies before McDowell's case was published.

Dr. Dixi Crosby (Dartmouth), 1801–1873, was the first in this country to remove the entire upper extremity with the clavicle and scapula, 1836. He discovered the method of reducing dislocations of the thumb and fingers by forced extension and pressure upon the base of the dislocated bone.

NEW YORK

Dr. John James (New York), 1729–1791, was the first to perform lithotomy in this country.

Dr. Samuel Bard (New York), 1742–1821, published the first book on midwifery in America (1807).

Dr. Richard Bayley (New York), 1745–1801, first pointed out the difference between membranous croup and diphtheria. He first amputated at the shoulder-joint.

Dr. John Bard (New York), in 1759, first performed gastrotomy in America for removal of an extra-uterine fetus.

Dr. Wright Post (New York), 1766–1822, was the first in America to ligate the femoral successfully for popliteal aneurysm, according to the Hunterian method (1796), also the first successfully to tie primitive carotid in its continuity, for aneurysm (1813), and the subclavian outside the scaleni (1812).

Dr. John Stearns (Saratoga), 1770–1848, more than any other called attention to the use of ergot as an oxytoxic.

Dr. Samuel Guthrie (Sackett's Harbor), 1782–1848, discovered chloroform in this country at the same time that it was discovered in Europe.

Dr. John S. Dorsey (New York), 1783–1818, first tied the external iliac.

Dr. Valentine Mott (New York), 1785–1865, was the first in the world to ligate the innominate artery (1818). Also the carotid for subclavian aneurysm (1829). Also the external iliac for femoral aneurysm (1831). Also the right subclavian between the scaleni (1833). Also both carotids simultaneously (1833). Also the right internal iliac (1837). He was the first to resect the right side of the lower jaw after tying the carotid artery (1821). Also the first to remove the left clavicle for sarcoma (1828) and a large fibrous growth from the nostrils by dividing the nasal and maxillary bones (1841.) He was the first to ligate the common iliac for aneurysm (1827).

Dr. J. K. Rodgers (New York), 1793–1851, was the first to wire for an ununited fracture of the humerus (1827). Was the

first to tie the left subclavian artery inside the scaleni for aneurysm (1845). Also the third portion of subclavian.

Dr. Willard Parker (New York), 1800–1884, first performed cystotomy for inflammation and rupture of the bladder. He first ligated the left subclavian inside the scaleni, together with the common carotid and the vertebral for subclavian aneurysm in 1864. He was the first in America to ligate the left subclavian artery in its third portion for a brachial aneurysm. He was the first in this country to incise through the muscular walls of the abdomen for perityphylitic abscess. He was the first to drain the bladder through the perineum in cases of hypertrophied growth. He was the first to excise the great trochanter in this country. He was the first in this country to operate for strabismus. His paper in 1867 was the first to compel the profession to recognize the need of operation for appendicitis.

Dr. S. Pomeroy White (New York), 1801–1867, first ligated the internal iliac artery for gluteal aneurysm (1827).

Dr. John Dupuy (New York), 1802–1866, was the first to emphasize the importance of diseased conditions of the tonsils. He invented an ingenious tonsillotome. He is one of the first to have established laryngology as a distinct part of regular medical practice. He first demonstrated that a foreign body could be introduced into the larynx without producing suffocation. He first treated laryngeal troubles with the mop long before the discovery of the laryngoscope.

Dr. Charles Harris (New York), in 1807, was the first to remove the thyroid gland.

Dr. Alonzo Clark (New York), 1807–1887, introduced the opium treatment of peritonitis.

Dr. Gurdon Buck (New York), 1807–1877, was the first to introduce the well-known apparatus for the treatment of fractures of the femur, commonly known as Buck's extension apparatus. He was the first to use strips of adhesive plaster to make extension in fractures, with pulleys and weights (1861). He first ligated simultaneously the primitive and the internal carotid. He first excised the olecranon process (1842).

Dr. William Detmold (New York), 1808–1900, was the first special orthopedic surgeon in this country, 1808–1900. He first perforated the ends of bones in ununited fractures. He first, in 1850, trephined for pus in the lateral ventricle.

Dr. Gunnings S. Bedford (New York), 1808–1870, established the first clinic for diseases peculiar to women.

Dr. James P. White (Buffalo), 1811–1881, first established an obstetric clinic in this country. He was the first to reduce by taxis an inversion of the uterus of eight days' standing.

Dr. Stevens (New York), in 1812, first ligated the internal iliac for aneurysm.

Dr. Isaac E. Taylor (New York), 1812–1889, was the first to demonstrate the non-shortening of the cervix during pregnancy, in which he anticipated Müller, to whom credit is generally given.

Dr. James R. Wood (New York), 1813–1883, was the first to perform subperiosteal resection of bone with reproduction of the bone. Was the first in America to divide the masseter muscle. Was the first to devise divisions of the peronei muscles in chronic dislocations of the tendon. Was the first to treat acute and chronic knee inflammation by division of the hamstring and tendon Achilles.

Dr. Henry M. Onderdank (New York), 1813, was the first to ligate the femoral artery for violent inflammation of the lower extremity.

Dr. Frank A. Hamilton (Buffalo) was the first to publish (1860) in America a complete treatise on *Fractures and Dislocations*, which has been translated into French and German and has passed through seven English editions. In 1854 he first used skin-grafting to cure ulcers.

Dr. Edmund R. Peaslee (New York), 1814–1878, was the first to introduce a catheter in the peritoneal cavity through Douglas's cul-de-sac to wash it out in cases of septicemia following ovariotomy.

Dr. John Murray Carnochan (New York), 1817–1887, first ligated the carotid on both sides for elephantiasis (1867).

He was also the first to resect the superior maxillary nerve with Meckel's ganglia for neuralgia (1858). He was the first to cure a case of ankylosis of the lower jaw by subcutaneously dividing the masseter. He was the first to excise the ulna (1853), the radius (1854), the os calcis (1857).

Dr. William H. Van Buren (New York), 1819–1883, first excised a portion of each vas deferens as a substitute for castration in cases of onanism.

Dr. Lewis A. Sayre (New York), 1820–1900. He was the father of American orthopedics. He filled in the Bellevue Hospital Medical College, the first chair of orthopedics created in this country. He was the first in America to perform without any resultant deformity the operation for morbus coxarius. He contributed an illustrated treatise on *Spinal Diseases and Spinal Curvature*. He devised the plaster jacket for Pott's disease, 1877. He wrote a *Practical Manual on Club-foot* (1869), which passed through many editions and was translated into several languages, including Japanese.

Dr. Beriah A. Watson (New York), 1836–1892, published an "Experimental Study of Lesions Arising from Severe Concussions."

Dr. Watson (New York), in 1847, first ligated the internal iliac for gluteal aneurysm.

Dr. Abraham Jacobi (New York) is the founder of American Pediatrics.

Dr. Edward C. Loring (New York), 1837–1888, invented an ophthalmoscope which is the most convenient and widely used.

Dr. Alexander J. C. Skene (Brooklyn), 1837–1900, described the para-urethral gland known as Skene's gland (1880).

Dr. Joseph O'Dwyer (New York), 1841–1898, perfected intubation in place of tracheotomy. The Fell-O'Dwyer apparatus was probably the first means ever used for inflating the lungs. He demonstrated that a tube could be retained continuously in the larynx without removal for months and even years.

Dr. Henry G. Piffard (New York), 1842–1890, wrote the first systematic treatise on dermatology in America (1876).

Dr. Charles McBurney (New York), 1845–1893, contributed considerably to the treatment of hernia (1878) and appendicitis. He discovered McBurney's point in appendicitis (1889). He devised the use of hooks for the reduction of dislocated fractured heads of the humerus.

Dr. George R. Fowler (New York) performed decortication of the lung as a means of treating old cases of empyema, with thickened pleura, long before Delorme (1893).

Dr. Wm. T. Bull (New York), 1849–1909, contributed considerably to the performance of laparotomy in cases of gunshot wounds of the abdomen.

Dr. Alonzo B. Richardson (New York), 1852–1903, was among the foremost of those who have led in the notable ameliorations and improvements in the treatment of the insane.

Dr. George M. Edebohls (New York), 1853–1908, first practised suspension of the kidney and decapsulation of the kidney in inflammatory affections (1901).

Dr. Augustus P. Dudley (New York), 1853–1905: Conservative treatment of the uterine appendages.

Dr. Wood (New York) was the first to remove the upper maxilla.

Dr. Frank Hartley (New York), 1856–1913, originated intracranial neurectomy for the second and third divisions of the fifth nerve for facial neuralgia.

Dr. James L. Van Ingen (Schenectady). In 1857 he was the first to practice elevation of the foot of the bed for counter extension in fractures.

Dr. George Huntington (Long Island) first described hereditary (Huntington's) chorea.

Dr. George M. Beard (New York), in 1868, first introduced in America the concept of neurasthenia or nervous exhaustion.

Dr. Fluhrer (New York), 1872, was the first to use flexible narrow strips of tin or zinc in the management of fractures. He was the first to locate a pistol-ball within the brain by the use of his special probe.

Dr. Sands (New York). In 1880 he first tied the primitive iliac for aneurysm of the left external iliac by performing preliminary laparotomy. In 1888 he first opened the abdomen with positive diagnosis and removed the appendix successfully.

Dr. Mason (New York), 1881, was the first to cure fractures of the nasal bones by passing a curved needle under the fragments and elevating them.

Dr. Wm. W. Reid (Rochester), in 1885, first systematically reduced dislocations by manipulation instead of main force.

Dr. Bernard Sachs (New York), in 1887, described amaurotic family idiocy.

Dr. Newman (New York), in 1888, devised an operation for shortening the round ligaments.

Dr. Unterbridge (New York), 1889, devised a speculum for dilatation of the cervix uteri.

Dr. John Ball (Brooklyn), (deceased, no dates) was the first to treat strictures of the uterine cervix and forcible dilatation with instruments.

Dr. E. Carr (Canandaigua) first suggested that the crepitation in pneumonia is due to the air rushing into and distending the bronchial vesicles which had been previously glued together by tenacious mucus.

Dr. Sabine (New York) (deceased, no dates) was the first to build a nose from the phalanx.

Dr. H. J. Knapp (New York), 1832–1911, devised an operation for removal of tumors from the optic nerve without sacrificing the eye. He devised a hook to extract foreign matter from the ball. He improved the ring forceps.

Dr. Samuel R. Perez (New York) (deceased, no dates) first demonstrated that spermatozoa could live as long as a week in the vagina, 1861.

Dr. John G. Koehler (New York?) (deceased, no dates) was the first in this country to perform synchronous amputation of both legs and one arm.

Dr. Lafayette B. Wendell (Delhi) did important work (with Osborne) on artificial foods.

Dr. Gunning, of New York (deceased, no dates), and Dr. Bean, of Georgia, simultaneously invented the interdental splint. It is thoroughly American.

Dr. Bachelder (New York) (deceased, no dates) introduced compressed sponges.

Dr. Gouley (New York) has contributed considerably to the treatment of stricture of the urethra by introducing the whalebone guide, the tunneled catheter staff, and the beaked bistoury.

Dr. Sass (New York) was among the first to introduce the treatment of laryngeal troubles by the spray method.

Dr. Ernest Krackowiser (New York) was probably the first physician in America to demonstrate the vocal cords.

Dr. Wadsworth (New York) invented the tilting mirror of the ophthalmoscope.

Dr. F. H. Bosworth (New York) first discovered the importance of excrescences upon the nasal septum as factors in causing obstruction. He devised a saw for the removal of septal spurs. He contributed considerably to place the science of laryngology and rhinology upon a firm scientific basis in America and in Europe.

Dr. Clinton Wagner (New York) developed the operation of thyrotomy.

Dr. Morris J. Asch (New York) has done valuable original work in correcting the deformities of the nose.

Dr. John C. Roe (Rochester) has done much original work for the relief of deformities of the nose.

Dr. Rufus P. Lincoln (New York) was a pioneer in the removal of retropharyngeal fibromata through the natural passages instead of after extensive preliminary operation.

Dr. John R. French (Brooklyn) devised a new and complete method for photographing the human larynx.

Dr. Thomas A. Emmett (New York) is preëminent as the one American who placed the perineal operation for the first time upon a sound, rational basis by devising a successful widely used procedure. In complete tear of the perineum his work is also supreme. He devised and extensively practised the operation

of the excision of the connective-tissue in the angle of a lacerated cervix associated with the denudation of the anterior and posterior lips and their union by suture. Dr. Emmett contributed considerably to the treatment of the ruptured vaginal out-let, including complete tear dividing the sphincter. His principal contributions are his papers on dysmenorrhea and sterility resulting from anteflexion of the uterus (1865), on the surgical treatment of lacerations of the cervix uteri (1869–74), his papers on vaginal cystotomy (1872), his monograph on vesicovaginal and rectovaginal fistulæ (1868); his plastic surgery of the perineum (1882). He devised an operation for prolapse of the uterus.

Dr. E. Noeggerath (New York) first reduced an inverted uterus by digital compression of both horns. He was the first to state that female pelvic inflammations were due to infection by gonococci transmitted by the male (1872); introduced "episiotomy."

Dr. Frederick S. Dennis (New York), 1889, was the first to ligate the two internal iliacs simultaneously on the same subject for double gluteal aneurysm.

Dr. A. Flint (New York) was the first in this country to call attention to the importance of distinguishing the variations of pitch elicited by percussion (1876). He was the first to state that rheumatism was a self-limited disease.

Dr. Austin Flint (New York City): In 1857 he made experiments showing that blood deficient in oxygen cannot circulate freely in the capillaries. The obstruction is in the systemic vessels and not in the lungs, in cases of asphyxiation. In 1861 he was the first in this country to confirm the experiments of Magendie in 1837 showing that the anterior roots of the spinal nerves possessed a slight sensibility derived from recurrent fibers from the posterior roots. In 1861 experiments on alligators of large size showed that the heart being excised from the body the valves between the cavities having been cut away, will beat powerfully with regular rhythm; while pulsations are more rapid, feeble, and irregular when the cavities are empty. The experiments on reproduction published in 1861 led him to

think that the "respiratory sense" had also origin in the general system and was due to want of oxygen. In 1862 he published his article on "The New Excretory Function of the Liver," which received from the Institute of France a recompense of 1500 francs and an honorable mention. In 1862 he described a new substance called stercorin, which substance resulted from a change of the cholesterin of the bile in its passage through the small intestine, incident to the process of intestinal digestion. In 1863 he published a new method to estimate albumin and fibrin in the blood. In 1870 he demonstrated that unusual muscular efforts largely increase the elimination of nitrogen by the kidneys. He thinks he is justified in claiming priority in the method of investigating the influence of exercise upon the excretion of nitrogen by comparing the nitrogen eliminated with the nitrogen of the food. In 1879 he demonstrated that heat production was due to oxidation of carbon and hydrogen. Lavoisier and Laplace had expressed the opinion but had not demonstrated it. He thinks he was the first to demonstrate positively that under conditions, at least, when oxidation represented by carbon dioxide and nitrogenous excretions is not sufficient to supply the heat required, water is produced in the body. He was the first to insist on the importance of examining the urine in all cases of application for life insurance, which was rarely done at the time (1871). In 1889 he had devised the formula of a tonic, endeavoring to make a preparation containing the inorganic constituents of the blood in about the normal proportions with an excess of iron and sodium chloride. It is called the "Saline Chalybeate Tonic." In 1892 he was the first to use bismuth subgallate in so-called functional dyspepsia attended with gastric and intestinal flatulence. In 1895 he published the first case on record of filaria, with chyle in which methylene blue was employed with a view to destroying the parasite. In 1867 he was the first to recommend dietaries for hospitals and asylums.

Dr. Robert F. Weir (New York): "Two Cases of Intratympanic Vascular Tumor with Pulsating Intact Drum Mem-

brane." "Traumatic Aneurysm of the Vertebral Artery Cured by Digital Compression." "On Fatty and Sarcomatous Tumors of the Knee-joint Affecting its Synovial Funges." "Decompression for Otherwise Inoperable Central Tumors." "Gastrorrhapy by Folding in the Stomach to Diminish the Size of a Dilated Stomach." For folds in the synovial membrane of the knee-joint, particularly on the surface of the patella begetting painful but temporary arrest of motion cured by opening joint and cutting off the fold. "For Relief of Acute Miliary Abscesses of the Kidney by Nephrectomy First Done by Me." "The Replacement of a Depressed Fracture of the Malar Bone." The relief was accomplished by opening the antrum above the canine tooth and by a sound there introduced the depressed bone was readily put in place. For increasing the space required for surgical work in acute or chronic cases of appendicitis it was suggested by me to enlarge the usual McBurney operation by cutting across to the median line, the front and rear layers of the rectal sheath and the peritoneum, the muscle itself being drawn strongly to the left. This avoids nerve damage. "On an Improved Operation for Acute Appendicitis or for Quiescent Cases, with Complications." "An Improved Method of Treating High-seated Cancers of the Rectum by Laparotomy, being an Elaboration of the Operation Devised by Morrison." The new use for the ureter appendix in the treatment of obstructive colitis showed how easily the appendix could be drawn to and extended at the skin level and subsequently opened to furnish a route to flush out by medicated solutions the large bowel.

Dr. Robert T. Morris (New York): Description of the experiments showing the mechanism of Pott's fracture and of fracture of the fibula by inversion of the foot. The mechanism of these two quite different fractures was compared. Description of experiments relating to the anatomy and mechanism of subluxation of the radius, and showed that the condition depended upon the orbicular ligament slipping between the head of the radius and the capitellum of the humerus. I showed that recovery presumably occurred eventually as a result of pressure

absorption of the interposed ligament. The idea of staining malignant tissues *in situ* by intravascular injections of staining agents in the hope that this might lead to a destruction of neoplastic cells. My first report upon the experiments was made in the *Medical Mirror* in 1891 before anyone else had made the attempt, so far as I know. This and subsequent attempts have not been successful. They have been of negative value so far, but introduced the idea before it was out abroad. Description of experiments relating to the prevention of secondary peritoneal adhesions by means of the aristol film. Description of a method for making a permanent suprapubic fistula by means of turning in ribbons of skin which are fastened to the bladder, giving us a permanent epithelial-lined canal. Study of experiments for the removal of carious and necrotic bones by means of preliminary decalcification with hydrochloric acid followed by digestion of the decalcified bone with pepsin solution. Experiments upon rabbits showing the nature of repair of the wound after abdominal operations. Report upon malignant disease of the navel as a secondary complication, showing that malignant disease sometimes appeared unaccountably at this point when it occurred elsewhere in a primary focus. Experiments with trypsin, pancreatic extract, and pepsin, employed for the purpose of removing blood and lymph coagula from cavities of the body and for liquefying sloughs. Description of the wick drain which has now been generally adopted everywhere. Study of the question if evolution is trying to do away with the clitoris. Experimental production of "mallet finger" showing that it was due to traumatic thinning of the extensor ligament attached to the terminal phalanx of the finger and was not due to rupture of a ligament. Endoscopic tubes for direct inspection of the interior of the uterus and bladder. These were not taken up extensively by the profession for the reason that various kinds of electrical apparatus came into the field and replaced my tubes. Use of the dowel pin for cases of dislocation of the acromial end of the clavicle, and in the following year described the use of the dowel pin in fracture of the clavicle. Experiments with rabbits

showing that ileal intussuception might be produced as a laboratory experiment by touching the bowel with a little carbonate of sodium, and I suggested that intussusception in infants might perhaps be explained on the ground that exteric toxins cause spasms of the muscularis in the same way as it was produced experimentally with carbonate of sodium. Experiments with cargile membrane employed for the purpose of preventing peritoneal adhesion formation. The pathology of involution of the appendix and its complications. Insidious peritoneal adhesions occurring in the upper part of the peritoneal cavity. Lane's first paper was published in the London *Lancet* for January of the same year, describing the adhesions about the ileum and right iliac fossa. Studies relating to appendicitis which were perhaps new. Proliferating endarteritis of terminal arterial branches of the appendix, showing that this occurred as a result of toxic influences, that the area supplied by any one terminal artery when deprived of blood supply was then open to attack by bacteria (and that accounts for ulcerative processes in the appendix). Since that time I have shown that proliferating endarteritis of small arteries of other parts of the enteron leads to such complications as ulcer of the stomach and duodenum, and that this is apparently the most common cause for such ulcers. The process results from excretion of toxins by the mucosa of the stomach and duodenum and such toxins cause local endarteritis of terminal arteries. New methods in technic in operative work which have since been generally adopted. Action of various solvents on gall-stones, showing that it is hopeless to attempt to dissolve gall-stones within the body. Influence of remains of the embryonic vitelline duct in the production of moist navels, and of eczematoid inflammation about the navel. Experiments seeking an explanation for the reason why patients recover from tuberculosis of the peritoneum, and came to the conclusion that saprophyte toxin destroyed the bacilli in the peritoneal cavity as it did in my test-tube cultures. Since that time I have reported upon experiments showing that the destruction of tubercle bacilli in the peritoneal cavity is brought about

by any measure which excites a high degree of peritoneal hyperleukocytosis. Experiments on ovarian grafting. Article on the subject of ovarian grafting, and in 1905 and subsequently have published many notes upon the subject. My own work antedated that of Chrobak and Knauer, and I do not know why they were given credit for inception of the idea, except perhaps upon the ground that it was "made in Germany." Case in which pregnancy resulted after ovarian grafting. Account of the facts relating to the Schede method of obtaining wound repair by means of the moist blood clot. This method was one which I had worked out experimentally and which I demonstrated at the clinic of Dr. Schede, of Hamburg. Schede at first objected very much to this method, saying it was dangerous, but succeeded in publishing a report upon cases, and obtaining credit for the procedure, before my own report had been published. In cases of chronic appendicitis the right group of lumbar ganglia was hypersensitive on pressure while the left group was not hypersensitive. 1910 I assembled data for the purpose of showing that we were about to enter a new era in surgery, which I called the fourth or physiological era. I showed the three previous eras consisted of the heroic, the anatomical, and the pathological. A method of examining fractures behind a fluoroscopic screen, and pinning fragments in place by means of a cannula and drill device which was described. Study in explanation for the reason why wounds in the upper part of the abdominal wall sometimes fail to make good repair. Method for quick repair of the perineum after exposure of the levator ani muscle. Description of an artificial synovial fluid, consisting of boroglyceride, glycerin, and normal saline solution. Method for longitudinal inversion of the bowel. This is to be tried out experimentally in the hope of replacing colectomy.

Dr. John A. Wyeth (New York): Ligation of the external carotid artery for a lesion of its branches instead of ligating the common carotid. Bloodless amputations of the hip-joint and shoulder. The cure of otherwise inoperable vascular tumors (angiomata) by the injection into their substance of water at a

high temperature. The immunizing effect upon sarcoma of a mixed pyogenic infection. The demonstration of the process of arterial occlusion by cell proliferation after ligation in continuity. Transplanting skin from the abdomen and other parts of the body to the hand and forearm. Transferring the graft by this means to the face, neck or elsewhere. Transplantation of the proximal end of the ulna to the distal of the radius in an ununited Colles's fracture. Hip-joint disease treated by combination of Hutchinson's high shoe and crutches and Sayre's long extension splint. A new procedure for the removal of otherwise inoperable tumors from the posterior pharynx. Novel procedure for restoring the anterior extremity of the radius. Treatment of caries of the lumbar spine by continuous extension. Femoral hernia—a new and successful method of obliterating the femoral canal. Founding of the first polyclinic school for postgraduates in America.

Dr. Lewis A. Stimson (New York) was the first to ligate the uterine and ovarian arteries preliminary to hysterectomy for fibroids and other affections. Later on Dr. Baer, of Philadelphia, substituted the mass ligature for the isolated ligature of the vessels. (Statement of Dr. Noble, of Philadelphia.)

Dr. Robert Abbe (New York): Treatment of strictures of the esophagus by the string method, in which a string is passed through the stricture and by working it up and down cuts through the stricture. Devised an operation for trigger finger. Was first (in America, at least) to cure a case of papilloma of the larynx by the use of radium. New plastic operation for the relief of deformity due to hare-lip. There was an extreme flatness and scantiness of the upper lip, with an enormous pouting and redundance of the lower one. The middle portion of the lower lip was transplanted into the upper.

Dr. Frederic S. Lee (Canton): Work on the physiology of muscles and fatigue (1905–13).

Dr. Edward Charles Spitzka (New York): Among original discoveries may be mentioned the interoptic lobe of the ignana, the identification of hitherto unrecognized postoptic lobes in

birds and reptiles, of the spinal course of the cortex lemnisans in man, the marginal tract (discovered a year later by Lissauer) variously referred to as the Lissauer or the Spitzka-Lissauer tract, of the auditory tract in the cetacea, and of the superficial decussation of the pyramids in pteropus.

Dr. J. Leonard Corning (New York): Discovered local anesthesia with cocain and hypodermic injections. Also spinal analgesia, but he only applied it to animals, not to the human (1885).

Dr. J. Riddle Goffe (New York): Method of covering the stump with peritoneal flaps after supravaginal hysterectomy for fibroid tumors. My operation for the relief of extreme cases of procidentia complicated by rectocele and cystocele. In this second operation the uterus is removed and the broad ligaments stitched together across the pelvis upon which is spread out the bladder by stitching the trigone to it in three places, etc. My theory for support rests upon the control of intra-abdominal pressure. I have worked out this theory and described the operation in detail in two or three articles.

Dr. Herbert Gillette (New York): Case in which diphtheria antitoxin was administered to a person who had asthma, and the patient died in a few minutes. My notes called attention for the first time to the danger of administering horse serum to a subject of asthma or to one who is susceptible to the odor of a horse or stable; also, it called attention to possible danger to subjects of hay fever, bronchitis, or any form of respiratory distress. It was a form of anaphylaxis in the human subject caused by horse serum as an excitor, and the immunizing dose so frequently administered is as dangerous as any when the above conditions are present.

Dr. Willy Meyer (New York): 1888, "A Successful Case of Colocolostomy." First case published of lateral anastomosis between parts of the large intestine. 1892, "Progress of Cystoscopy in the Last Three Years." First statement in the literature of the rhythmical movements of the mouth of the ureter as they appear during cystoscopy. 1892, "Nephrotomy for the Relief of Sudden Total Suppression of Urine, Occurring Some-

time after Nephrectomy." First advice to perforate capsula propria of kidney in case of total suppression of urine. This advice was later enlarged by Dr. Edebohls, who recommended decapsulation. 1894, "Portable Sterilizer for Private Operations." So far as I know, the first portable sterilizer for surgical purposes. 1894, "An Improved Method of the Radical Operation for Cancer of the Breast." First publication in *New York Medical Record*, December 15, 1894. 1905, "Carcinoma of the Breast." First report on the now generally adopted radical operation for cancer of the breast, which means removal of the cancer with both pectoral muscles *in toto*, plus axillary and subclavian glands with surrounding fat, in one mass. In this operation the bloodvessels are ligated and divided at their point of exit from or entrance into the main vessels, thus reducing the loss of blood to a minimum. 1896, "Early Diagnosis of Tuberculosis of the Kidney." First statement in the literature of the cystoscopic picture of the traces left within the healthy bladder by the urine descending from a tuberculous kidney. 1900, "The Hockey-stick Incision." Description of a practical method of abdominal incision for appendicular trouble combined with disease of the appendages. 1903, "The Improvement of General Anesthesia on the Basis of Schleich's Principles." 1908, "The Improvement of General Anesthesia on the Basis of the Principle of Adapting the Boiling-point of the Anesthetic to the Temperature of the Body (Schleich); Ten Years' Experience." New anesthetic mixture of chloroform, ether, and ethyl chloride, the boiling-point of which is adapted to the body temperature. 1904, "Osteoplastic Gastrotomy for Impermeable Cicatricial Stricture of the Esophagus." Attacking impermeable cicatricial stricture of the esophagus from below, with the help of an osteoplastic flap, in the presence of a gastric fistula. 1909, "Fortschritte in Druckdifferenzverfahren f. Intrathorakale Operationen." 1909, "Pneumectomy with the Aid of Differential Air-pressure; An Experimental Study." A practical combination of the positive cabinet with the negative chamber, permitting of change from positive to negative pressure at will, leaving

patient undisturbed in his position on the operating table. 1911, "Inoperable Cardiospasm Successfully Treated by Thoracotomy and Eosophagoplication." Loosening the pneumogastrics from the supradiaphragmatic pouch in cases of cardiospasm, with reduction of size of pouch by single or double plication. Spontaneous return of the ability to swallow has been observed in one patient, permanently up to the time of death, one year after operation, temporarily only in the second patient. 1911, "Subcutaneous Injection of Normal Human Blood Serum to Prevent and Overcome Postoperative Hemorrhage in Patients with Chronic Jaundice." Making use of Dr. Welch's proposition of subcutaneous injection of normal human blood serum as a preventive against postoperative (secondary) hemorrhages in cases of chronic jaundice. 1912, "The Operative Treatment of Intractable Cardiospasm." Making use of the Heinecke-Mikulicz method of pyloroplasty for the cardia in cases of cardiospasm. 1912, "On Drainage after Intrathoracic Operations, with Special Reference to the Esophagus." 1912, "Zur Drainage nach Intrathorakalen Operationen." Draining the pleural cavity after intrathoracic operations as in abdominal cases, keeping the patient under differential pressure for fifteen to twenty hours. 1914, "On Bronchiectasis." Proposition to spray collargol into the bronchial tree in order to improve results of radiography (still in experimental stage). 1914, "Extrathoracic and Intrathoracic Esophagoplasty in Connection with Resection of Thoracic Portion of Esophagus for Cancer." Using the Beck-Jianu tube obtained by a plastic operation from the major curvature of the stomach for intrathoracic esophagoplasty, *i. e.*, to have this tube replace the lower portion of the resected esophagus, making it pass through the foramen esophageum alongside the closed cardia and uniting it with the proximal stump direct by suture.

Dr. Irving S. Haynes (New York): 1796–1879. In the treatment of badly united Pott's fracture at the ankle, I claim originality and priority for the method of treatment as set forth in my reprint, viz., "To Reproduce the Lesions of the Original

Injury and Treat the Case as if a Recent Fracture." The operation was performed in June, 1888. I claim that I was the first to devise and apply the principle of "composite photography" to determine the relations of the thoracic and abdominal viscera to the surface of the body and to each other. An original technic for "Drainage of the Cisterna Magna in Meningitis." An original plan for the "Treatment of Hydrocephalus by Deflecting the Cerebrospinal Fluid into the Blood Stream by Means of a Silver Tube" connect the cisterna magna with one of the sinuses, preferably a lateral. I call the method "Cisterna-sinus drainage for hydrocephalus." An original technic for the treatment of very large (giant) ventral hernia.

Dr. Hermann Knapp (New York): Work in ophthalmology.

Dr. W. B. Coley (New York): "Treatment of Inoperable Malignant Tumors by Repeated Inoculations with Living Cultures of the Streptococcus of Erysipelas. The Therapeutic Value of the Mixed Toxins of the Streptococcus of Erysipelas and Bacillus Prodigiosus in the Treatment of Inoperable Malignant Tumors, with a Report of 160 Cases."

Dr. Charles L. Dana (New York): "Benignity of Syphilis." The disease very often ran a benign course among a class of men who lived out-of-doors, and I believe I was among the first to call attention to the fact that "out-of-doors" was as good for syphilis as for tuberculosis. "Nerve Weakness." I tried to convince the people at that time of the existence of a functional neurosis (neurasthenia), of which the evidence was not at that time acknowledged. In my article on "Pathological Anatomy of Tic Douloureux" I described specimens which showed that the disease was due to a morbid condition of the vascular supply of the nerve rather than to disease of the nerve itself. That was subsequently confirmed by others, and it is my view of the pathology of the disease now. New method of treatment of the disease by massive doses of strychnin, a treatment which still retains an important position in neurological therapeutics. "Trigeminus Paralysis." All the nerves of taste came primarily from the glossopharyngeal, a view which has much support at

the present time. Articles on combined sclerosis. Dr. Putnam and I were the first to describe this disease and to give pathological records of the condition of the spinal cord. In later articles I showed its important relationship to pernicious anemia. Clinical study of neuralgias. I gave the first systematic picture of the location of various reflex pains. It was an elaboration of this original view of mine which Dr. Head subsequently worked up so much more completely. "Acute Transverse Myelitis with Perforating Necrosis." I gave the first description of that peculiar form of pathological disturbance. Pathological anatomy of chorea. Contributed to establish the fact that in chronic myoclonias the cortex is the main seat of the lesion. Progressive Senile Paraplegia. I reported a case which represents, so far as I know, the first record of the condition of the spinal cord in senile paraplegia. "Cerebral Hemorrhage and Softening." I showed that there was in general a difference in the temperature of the two sides in hemorrhage but not in thrombosis, and a difference in blood-pressure. These articles contained also studies of the localization of heat centers and studies of etiology showing the clinical facts regarding the importance of syphilis as a cause of cerebral hemorrhage. "Alcoholism and Inebriety." I have studied and examined the brains of many cases of so-called "alcoholic wet-brain." I think these were the first articles to call attention to what is described as "serous meningitis." "Pathology of Hereditary Chorea." I showed the cortical changes which occur in this disease. This was one of the first but perhaps not the very first article which proved that it was a cortical disorder. Changes in the shape and position of the uvula as one of the minor stigmata of degeneration. "Basedow's Disease." I reported a case which confirmed, I thought, my position that in this disease the primary lesion is bulbar and nervous and that the enlargement and over activity of the thyroid are secondary to the central neuro-pathological conditions. "Cerebellar Seizures." I described a peculiar form of "fit" due to extracerebellar lesions. These cerebellar fits had been described by Hughlings Jackson, but he did not, I think,

describe them as part of the disease in tumors of the brain. I have confirmed my original article by subsequent observation though it is only in certain types of tumors, those which grow with some rapidity and which are mainly outside the cerebellum, that the fits occur. "The Zoöphil-Psychosis" is a new disease which has been received with much applause by the worker in experimental medicine, and I think its establishment has been of some use to the world. "The Pineal Gland," done by Dr. Berkeley and myself, and originated at my suggestion, in which we succeeded in, I think, proving that the pineal gland has some function. Our experiments led mainly to the view that it has some stimulus on mental and sexual and somatic growth. We particularly worked on the mental side and we feel quite sure that the pineal gland is of some importance in certain classes of mental defectives.

Dr. H. Beeckman Delatour (New York): "New Colostomy Apparatus." I described an entirely new apparatus, designed by myself, which has given very general satisfaction to the patients about twenty-five or thirty, who are using it. Drew attention to the condition occurring at the sigmoid which was first described by myself. It obstructs the intestinal canal by angulating the bowels at one or the other end of the sigmoid. Described a series of cases in which the large intestine failed to rotate and irregular positions of the appendix were found, when operating for appendicitis. Called attention to the advantages of the early operation for the suture of the patella in cases of fracture. Described the particular method of suture shown to be most practical, the straight suture, which passes from the patella ligament to the quadriceps tendon and relieves the suture holding the bone together of all strain.

Dr. A. Rose (New York): "Carbolic Acid." The treatment of dysentery (first introduced by me in 1883). "The Cure of Rectal Fistula and Dacryocystitis by Means of Carbonic Acid Gas." "Enteroptosis and Its Treatment by Means of the Plaster Belt." Facts showing the relations of enteroptosis to circulation and innervation, the relation of enteroptosis to

cholecystitis and to mucous colitis. The plaster belt has first been introduced by me in the year 1899 and it is known under my name. "The Continuous Warm-water Bath the Rational Remedy in Tuberculosis (Phymatiasis) and Infectious Diseases in General." "The Treatment of Infectious Diseases by Means of the Continuous Warm-water Bath." "Ichthyol in the Treatment of Psoriasis."

Dr. F. Kammerer (New York City): First to contribute an article on unilateral infection of the kidney, suggesting as an etiological factor the floating kidney in women and also a method of surgical treatment. Also "Modified Incisions at the Outer Border of the Rectus for Appendicitis (Kammerer's Incision)."

Dr. L. L. Nascher (New York City) claims to be the first to have given the name of geriatrics to the disease of old age.

Dr. Edward A. Spitzka (New York): Performed autopsy and studied brain of Czolgosz, assassin of President McKinley, and published several articles on brain anatomy while a senior in medical school. Has studied the brains of many eminent men and of various races (Eskimos, Chinese, Japanese, Negroes, Papudans, Nicobarese, Anamanese, Malays, etc.). Published first accurate topographic projections of the lateral ventricles of the brain (1900). First observations of hereditary resemblances in brains of blood relatives, 1900 and 1903. Pointed out the relative redundancy of the peninsula (1901), the relatively larger size of the callosum (1906), and other cerebral characteristics in the brains of distinguished men. Described and named the postorbital limbus at the base of the human brain (1903). Established the existence of a lesion, hitherto undescribed, in the brains of persons killed by electricity. Described the occurrence in the twentieth century of epidemics of religious fanaticism (1903).

Dr. Simon Flexner (New York City) was the first to inject the antimeningococcus serum into the spinal subdural space, thereby obtaining a larger percentage of cures, especially in the early stages of the disease. He with Drs. Noguchi and Anos

discovered the germ of anterior poliomyelitis. He distinguished himself by his work on terminal infection, his experimental work on venoms and the etiology and therapy of cerebrospinal meningitis and infantile poliomyelitis.

Dr. Hidego Noguchi (Rockefeller Institute, New York City), with Drs. Flexner and Anos, has found the germ of anterior-poliomyelitis. Has discovered the method of cultivation. He has grown the spirochete of syphilis. He has grown the virus of rabies. He also perfected a blood test for syphilis. Also perfected a test of spinal fluid for syphilis.

Dr. Peyton Rous (Rockefeller Institute, New York City): Transmission of a malignant new growth by means of a cell-free filtrate. A tumor of chicken, histologically a spindle-cell sarcoma, has been propagated in this laboratory since October, 1909, and in the past few months has developed extreme malignancy. From a bit inoculated into the breast muscle of a susceptible fowl there develops rapidly a large, firm growth; metastasis takes place to the viscera; and within four to five weeks often the host dies. The behavior of the new growth has been throughout that of a true neoplasm, for which reason the fact of its transmission by means of a cell-free filtrate assumes exceptional importance.

Dr. L. G. Meltzer (Rockefeller Institute) originated intratracheal insufflation (1909) with John Auer; also the treatment of tetanus with magnesium sulphate (1905–6).

Dr. Alexis Carrel (Rockefeller Institute, New York City): Preservation of life in tissues and organs outside of the body. Transplantations of tissues and organs from one subject to another. "Thyroid Gland and Vascular Surgery." The purpose is to examine what may eventually be the influence of vascular surgery on the therapeutics of the thyroid gland. "Experimental Operations on the Sigmoid Valves of the Pulmonary Artery." The purpose is to ascertain whether and to what extent intracardiac operations could be performed with safety. The technic of interthoracic operations. The purpose is to describe the methods by which the occurrence of pleurisy and of air emboli of the coronary arteries has been prevented.

Dr. Jacques Loeb. His most characteristic work is that upon the dynamic and chemodynamic theory of living processes. He was one of the first to settle the question of what order of magnitude is the smallest particle that can show all the phenomena of life (1893). The experiments made by himself and pupils upon temperature coefficients have established other important criteria of physiological processes. He has made extensive investigations of the effect of electrolytic, thermal and radional energy upon living matter. He founded the theory of "tropisms" (1890) as the basis of psychology of the lower forms of life, purely mechanical and chemical data, displacing the old theory of purposeful instructive reactions. He caused the unfertilized eggs of the sea urchin to develop into the swimming larvæ by treating them with hypertonic sea water, *i. e.*, in which the concentration had been raised by the addition of salt or sugar (1899). Thus the ovum can be activated just as a protozoön can be rejuvenated or an asphyxiated body resuscitated by purely physicochemical means.

Dr. H. R. Gaylord and Dr. G. H. Claws (Buffalo) inoculated rats and mice with cancer.

Dr. Harry Plotz discovered the germ of typhus fever (Bacillus typhiexanthematici) in 1915.

Dr. Walter W. Brickner discovered new pathology of shoulder disability (subacromial bursitis) and new mechanical and surgical treatment for same (1914–15).

Dr. J. Henry Dowd (Buffalo): The phosphatic index, or pulse of the nervous system. The phosphatous for taking the phosphatic index. A modification of the urethral sound, the Dowd sound.

Dr. Max Einhorn (New York): Work in gastro-enterology.

The Rockefeller Institute for Medical Research is the grandest contribution of its kind in the world.

The Carnegie Foundation for the Advancement of Teaching is a great contribution to Medical Science. As a private munificient institution it is unique in the world.

Dr. E. L. Trudeau (Saranac Lake) is the first to have introduced in America the open-air treatment of tuberculosis.

Dr. Henry L. Elsner (Syracuse) published the first complete treatise on prognosis (1716).

NORTH DAKOTA

Dr. E. P. Quain (Bismark): The necessity of conserving the intercostal nerves in abdominal incisions. An experimental study.

OHIO

Dr. Daniel Drake (Cincinnati), 1785–1852, published one of the first accounts in literature of the local disorder known as the "trembles," or milk sickness (1841). His great work is on the *Diseases of the Interior Valley of North America*. The book is distinctly and peculiarly American (1850–54). It was the first book of importance on medical topography.

Dr. Marmaduke B. Wright (Cincinnati), 1803–1879, performed bimanual version before Hecht (1854).

Dr. Phineas S. Conner (Cincinnati), 1839–1909, first performed a complete eversion of the stomach. He contributed monographs on gunshot wounds and injuries and diseases of muscles, tendons, and fascia.

Dr. E. Watkins (Cincinnati) was the first physician in America who made ophthalmology an exclusive speciality.

Dr. Rufus B. Hall (Cincinnati): I was the first in America to remove a calculus, lodged in the ureter, by the combined abdominal and lumbar incisions. I was the first to suggest closing the pelvic peritoneum, after making a hysterectomy. I was the first to suggest that gall-stones, long neglected, had a causative relation to cancer in and about the gall-ducts. I was the first to suggest and make a bloodless operation for the removal of intraligamentous cyst of the ovary. This was done by cutting off the blood supply before enucleation of the tumor; by the ligation of the ovarian arteries; then by ligating the uterine artery on the side of the easiest approach; then cut across the neck of the uterus and clamp the second uterine artery, after

which the tumor was enucleated from below upward. I was the first to make the bloodless operation for removal of fibroid tumors of the uterus. By cutting off the blood supply, ligating the ovarian arteries, then the uterine artery on the side of the easiest approach; then cut across the neck of the uterus and clamp the second uterine artery, thus making it possible to enucleate all such tumors from below upward, without great loss of blood. I was the first one to use the method of elevating the hips and body of the patient in pelvic and abdominal operations now known as the Trendelenburg position. The operation was made upon a patient by name of Mary Vater, of Newport, Ky., on June 17, 1889, at my private hospital, 154 W. Eighth Street, Cincinnati, Ohio. There were present at the operation Dr. Edwin Ricketts (deceased), Dr. C. A. L. Reed, and Dr. C. B. Van Meter, all of this city. The last two are living, and would be willing to testify as to the correctness of this statement. Sometime after this Trendelenburg published a paper, describing the position for operations in the pelvis. I therefore did not publish my claim at all, yet I feel that I should have done so. Before he published his paper I had used the position several times in difficult operations, and so had Dr. Reed, of this city, he having seen me use it with such great advantage to the operator and patient.

Dr. Reid Hunt (Martinsville): Book on *Thyroid and Pharmacology*.

Dr. D. T. Vail (Cincinnati) reports what he believes to be the first case of infection of the human eye from the virus of a plague-like disease among rodents, notably the California ground squirrel, and now known as "squirrel plague."

Dr. George N. Stewart: Work on *Physiology and Pharmacology*.

Dr. Forald Sollman, also.

Drs. W. B. Wherry and B. H. Lamb (Cincinnati) believe they reported the first instance of human infection with the organism discovered by McCoy and Chapin in a plague-like disease first described by McCoy in the California ground squirrel.

Dr. Howard Taylor Ricketts (Findlay, O.) demonstrated wood-tick to be the vector of Rocky Mountains spotted fever (1907) and louse of Mexican typhus or tabardello (1910).

Dr. F. W. Langdon (Cincinnati): "Surgical Anatomy of the Brain." By means of six lines, based on anatomical landmarks only, without measurements in inches or millimeters, or apparatus of any kind, excepting an ordinary steel tape line, or a narrow strip of card-board, we may locate upon the living head most of the important surgical regions of the brain and its membranes: and I venture to state that the rules here laid down will be found as reliable in practice as the most elaborate systems of mensuration, or craniometry by more or less complicated apparatus.

Dr. H. McE. Kower (Cincinnati): "Origin of the 'Nasutus' (Soldier) of Eutermes." "Pteropods with Two Separate Openings." "The Embryology of a Termite." "A Comparative Study of the Development of the Generative Tract in Termites." "A New and Sensitive Method of Injecting the Vessels of Small Embryos, etc., under the Microscope." "Effects of Early Removal of the Heart and Arrest of the Circulation on the Development of Frog Embryos." "The Origin and Development of the Anterior Lymph Hearts and the Subcutaneous Lymph Sacs in the Frog." "Demonstration of the Interventricular Muscle Bands in the Adult Human Heart." "A Comparative Study of Embryonic Bloodvessels and Lymphatics in Amphibia."

Dr. Martin H. Fischer (Cincinnati): Contributions to the establishment and development of the colloid-chemical theory of water absorption. Too long to summarize.

Dr. George W. Crile (Cleveland): 1905, "Observations on Cancer of the Breast, with Analysis of 91 Operative Cases." "New Operations for Hernia of the Pelvic Floor (Procidentia), with Report of a Case." "Scope and Problems of Surgical Physiology." "Some Observations on Effect of Alternating Currents of Moderate Frequency on Dogs." (In collaboration with J. J. R. McLeod.) "Surgical Physiology." 1906, "Excision of Cancer of the Head and Neck, with Special Reference to

the Plan of Dissection, Based on 132 Operations." "Experimental and Clinical Observation upon Direct Transfusion of Blood." "Experimental Research into the Resuscitation of Dogs Killed by Anesthetics and Asphyxia." (In collaboration with D. H. Dolley.) "On the Surgical Treatment of Cancer of the Head and Neck, with a Summary of 121 Operations Performed upon 105 Patients." "On the Technic and the Results in the Excision of Cancer of the Head and Neck." "Report of Case of Multiple Giant-cell Sarcoma." (In collaboration with W. C. Hill.) "Technic of Operations upon the Face and Neck." "Treatment of Hemorrhage." 1907, "Effect on the Normal Dog Heart of Expressed Tissue Juice from Hearts of Dogs Poisoned with Diphtheria Toxin." (In collaboration with J. J. R. MacLeod.) "Further Consideration of Surgical Treatment of Cancer of the Head and Neck." "Further Consideration of the Treatment of Cancer of the Neck." "Further Experimental and Clinical Observations on the Transfusion of Blood." "Goitre." "On the Direct Transfusion of Blood. An Experimental and Clinical Research." "Transfusion in Dogs upon Which Bilateral Nephrectomy has been Performed." (In collaboration with H. P. Cole.) "On the Plan of Excision in Cancer of the Head and Neck, and an Analysis of 132 Cases." "Preliminary Note on the Direct Transfusion of Blood in Pernicious Anemia, Leukemia, Carcinoma, Chronic Suppuration, Surgical Hemorrhage, Tuberculosis, Surgical Shock, and the Transference of Immune or Protective Bodies in Self-limited Diseases, Illuminating Gas-poisoning, Bleeding, and Transfusion in Toxemia and Drug Poisoning." "Preliminary Report on the Direct Transfusion of Blood in Animals Given Excessive Doses of Diphtheria Toxins." "Summary of 1000 Cases of Appendicitis, with Observations on Etiology." "Transfusion Experiments on Dogs, showing Artificially Implanted Tumors." "Treatment of Illuminating Gas Poison by the Direct Transfusion of Blood." 1908, "The Cancer Problem." "Hemolysis, with Special Reference to Cancer and Tuberculosis." "Further Observations on Its Clinical Aspect." "Hemolytic Tests for Cancer." "Hemo-

lytic Tests for Malignant Tumors." "Hemorrhage and Transfusion." "Observations on Surgery of the Thyroid Gland, with Special Reference to the Psychic Factor in Graves's Disease." "On the Direct Transfusion of Blood." "Surgery of the Stomach Based on 104 Personal Cases." "Surgical Aspects of Graves's Disease, with Special Reference to the Psychic Factor." "Surgical Shock." "Transfusion of Blood in the Transplantable Lymphosarcoma of Dogs." (In collaboration with S. P. Beebe.) 1909, "Certain Phases of Acute Anemia." "Further Observations on the Clinical Aspect of Hemolysis." "Further Observations on Transfusion, with a Note on Hemolysis." "Hemorrhage and Transfusion." "Medicine and the Press." "Note on Nitrous Oxide and Oxygen Anesthesia in Comparison with Ether Anesthesia." "Observations on Cancer." "Observations on Surgery of the Thyroid Gland with Special Reference to the Psychic Factor in Graves's Disease." "Pathological Cytology of Surgical Shock; a Preliminary Communication: the alterations occurring in the Purkinje cells of the dog's cerebellum, with an introductory note on the pathological physiology." "Subjective Symptoms of Exophthalmic Goitre; a Personal Experience." "Surgical Anemia and Resuscitation." "Surgical Shock (Harvey Lecture)." "Technic of Cesarean Section." 1910, "Address on Cancer." "Experimental and Clinical Research into Nitrous Oxide Versus Ether Anesthesia: an Abbreviated Report." "Further Observations on Hemolysis in Cancer." "On Cancer." "On Certain Factors that Influence the Immediate Results of Surgical Operations." "On the Direct Transfusion of Blood." "On the Factors of Safety in Abdominal Operations." "On the Neurocytological Changes in Shock, Infection, Graves's Disease, and Certain Drugs, with a Note on Fear in Rabbits." "Operations on Handicapped Patients." "Phylogenetic Association in Relation to Certain Medical Problems." "Postoperative Results in Exophthalmic Goitre." 1911, "Anoci-association: a New Principle in Operative Surgery." "Goitre: Some Biological Considerations." "Graves's Disease; a New Theory of Operations Based upon a

Study of 352 Operations." "Newer Methods for Further Increasing the Safety of Surgical Operations." "A New Principle in the Treatment of Graves's Disease." "Nitrous Oxide Anesthesia and a Note on Anoci-association; a New Principle in Surgery." "Phylogenetic Association in Relation to Certain Medical Problems." "Phylogenetic Association on Relations to Graves's Disease and Sexual Neurasthenia." "Some of the Factors that Influence the Prognosis in Operations for Cancer." "Surgical Aspects of Painful Digestion." 1912, "Anoci-association: a New Principle in Surgery." "Anesthesia and Anoci-association." "Comparison of Anesthesia in Plants Possessing a Motor Mechanism and Animals." (In collaboration with M. L. Menton.) "End-results of Operation in Graves's Disease." "Laryngectomy for Cancer." "New Principle Underlying the Interpretation of Clinical Phenomena of the Abdominal Viscera, with Special Reference to Emotional and Painful Indigestion." "Phylogenetic Association in Relation to the Emotions." "Results of Operations, Especially Abdominal, Formed on the Principle of Anoci-associations." "Surgical Aspects of Graves's Disease." 1913, "Anesthesia and Anoci-association." "Anoci-association: a New Principle of Surgery." "Biological Interpretations and Surgical Aspects in Painful Digestion." "Further Control of the Morbidity and the Mortality in Abdominal Operations for Pelvic Diseases." "Identity of Cause of Aseptic Wound Fever and So-called Postoperative Hyperthyroidism and Their Prevention." "Indications and Technic in Gastric Resection and Gastroenterostomy." "Kinetic System: Theory." "Laryngectomy for Cancer." "Mechanistic View of Psychology." "Possible Surgical Control of Kinetic System." "Present-day Conceptions of the Pathological Physiology of Graves's Disease from the Surgeon's Viewpoint." "Relation between the Blood-pressure and the Prognosis in Abdominal Operations." "Relation between the Physical State of Brain Cells and Brain Functions. Experimental and Clinical." "Shock." "Some Newer Methods of Reducing the Mortality of Operations on the Pelvic Organs." "Successful Method of Performing Shockless

Operations Based on a Clinical Experience of 3000 Cases." "Transfusion of Blood." 1914, "Acidity, Alkalinity, and Anesthesia." "Anoci-association." "Anoci-association in Relation to Operations on the Gall-bladder." "Cholecystectomy versus Cholecystostomy and Method of Overcoming Special Risks Attending Common Duct Operations." "Drainage versus Immediate Suture of the Common Duct." "Kinetic Chain for Transformation of Latent Energy." "Kinetic System." "Liver in its Relation to Operations on the Biliary Tract and Stomach." "Shock." "Two-stage Operations, Especially in its Relation to Treatment of Cancer." "Wayside Notes of Visits to German Clinics in June, 1912." 1915, "Emotions, Their Origin and Nature." Although the foregoing publications contain more or less original view-points, Dr. Crile states that the block excision of lymphatic gland bearing tissues of the neck, including the sternomastoid muscle and the internal jugular vein, was not presented before it was devised by him; resuscitation from recent death by the use of adrenalin and rhythmic pressure was new also; the conception of nerve-blocking for the prevention of shock and the elaboration of anoci-association in surgery was new, as were likewise the pathology of shock as represented by the changes in the brain, adrenals, and the liver; the conception of the kinetic system and the origin of the emotions and identification of the lesions caused by them.

Dr. William Townsend Porter (Plymouth): Important Work on *Physiology of Circulation*. "Measurements of School Children." Financed *American Journal of Physiology* until 1915.

Dr. Frank E. Bunts (Cleveland): "Separation of the Colon from its Mesentery," showing that the colon would live when separated from a considerable portion of the mesentery after resection of the mesentery to the gut. Devised a pneumatic tourniquet-diverticle of the cecum following appendectomy.

Dr. Edwin G. Conklin (Waldo): Work on *Zoölogy*.

Dr. J. F. Baldwin (Columbus): The method of anchoring the kidney, for which I claim priority, is that by which a column of muscular tissue is taken from one side of the incision around

which flaps made up of kidney capsule are brought and sewed, so as to secure complete and permanent anchorage. The making of an artificial vagina by transplanting a piece of bowel, is, I think, original from start to finish. A German surgeon, and also a Japanese surgeon, got up something of the same, or claimed to, but I had fully a year priority in point of publication, and I think at the present time priority is conceded to me by all the authors.

Dr. William E. Castle (Alexandria, O.) work on heredity (1911).

PENNSYLVANIA

Dr. Thomas Cadwalader (Philadelphia), 1708–1779, published a classical account of lead-poisoning in the eighteenth century (1745).

Dr. John Morgan (Philadelphia), 1735–1789, and Dr. William Shippen, Jr., 1736–1808, founded the Medical Department of the University of Pennsylvania (1740).

Dr. William Shippen, Jr., (Philadelphia), 1736–1808, was the first professor of obstetrics.

Dr. Benjamin Rush (Philadelphia), 1745–1813. He was the first after Bylon of Java to describe dengue (1780). He was probably the first to note that thermal fever occurred by drinking cold water when exhausted. His monograph on *Insanity* (1812) has been pronounced by Mills to be, with that of Isaac Ray, the only systematic American treatise on the subject before the year 1883. His paper on the "Diseases of the North American Indians and Their Vices" was perhaps the earliest American contribution to anthropology (1774–98). He contributed much to the prestige of American medicine, being one of the signers of the Declaration of Independence. He was the first to lecture on jurisprudence.

Dr. Caspar Wistar (Philadelphia), 1760–1818, wrote a description of the ethmoid bone which was praised by Soemmerring. He published the first book on anatomy in America. The Wistar Institute of Anatomy and Biology is the only institution of its

kind in America. It was founded by General Caspar, the grandson of Dr. Wistar, in memory of Dr. Wistar.

Dr. Thomas C. James (Philadelphia), 1766–1835, is said to have been the first to induce premature labor for a contracted pelvis.

Dr. William Potts Dewess (Philadelphia), 1768–1841, exerted a powerful influence as professor of midwifery at the University of Pennsylvania.

Dr. Philip Syng Physick (Philadelphia), 1768–1837, first used animal ligatures (1816). He invented the tonsillotome (1828). He advocated rest in the treatment of hip-joint disease (1830). He was the first in this country to puncture the head for hydrocephalus. He was the first to place internal urethrotomy upon a scientific basis by designing in 1795 a catheter bearing a concealed lancet which could be projected at will. He was the originator of an operation for the cure of artificial anus (1826). He was the first in this country to devise a stomach tube to remove poison from the stomach. He was the father of American surgery. In 1802 he passed a seton between the ends of an ununited fracture. He was the first to practice complete and protracted rest in the treatment of affections of the joints.

Dr. John Rhea Barton (Lancaster, Pa.), 1774–1871, was the first to perform osteotomy for ankylosis of the hip-joint (1826). He was the first in this country to trephine the vertebræ in cases of fractures and dislocations. He was the first to wire a fractured patella. He was the first to describe, in 1835, the fracture of the lower extremity of the radius known as Barton's fracture.

Dr. John Conrad Otto (Philadelphia), 1774–1884, published first paper on hemophilia.

Dr. N. Chapman (Philadelphia), 1780–1853, published the first book on *Therapeutics and Internal Medicine* in America.

Dr. John S. Dorsey (Philadelphia), 1783–1818, published the first book on *Elements of Surgery in America*. He was the first in America to ligate the external iliac for inguinal aneurysm (1811).

Dr. William Gibson (Philadelphia), 1788–1868, was the first in the world to divide the muscles of the eye for the cure of strabismus (1842).

Dr. Alexander H. Stevens (Philadelphia), 1789–1869, first described the abnormalities of equilibrium of the ocular muscular apparatus and the resulting disturbances.

Dr. Samuel Jackson (Philadelphia), 1790–1872, published the first book on the *Principles and Practice of Medicine* in America.

Dr. Charles D. Meigs (Philadelphia), 1792–1869, first called attention to cardiac thrombosis as a cause of the sudden death which occurs in childbed.

Dr. John Kearsley Mitchell (Philadelphia), 1793–1858, was the first to describe the neurotic spinal arthropathies (1831).

Dr. William E. Horner (Philadelphia), 1793–1853, discovered the muscle of the eye that bears his name, the tensor tarsi (1824). He was the first in this country to remove almost all the upper jaw without any external incision in the cheek. He was the first to prove that the rice-water discharges of cholera were due to the stripping of the epithelium of the mucous membrane (1834). He investigated the odoriferous axillary glands of the negro, the muscular tube of the rectum, and the membranes of the larynx.

Dr. George McClellan (Philadelphia), 1796–1847, was the first to remove all the lower maxilla immediately in front of the two angles. He is the founder of the Jefferson Medical College.

Dr. Isaac Hays (Philadelphia), 1796–1899, devised a needle knife for the comminution of cataract.

Dr. Robert Thompson (Philadelphia), 1797–1865, discovered the connection between astigmatism and posterior staphyloma.

Dr. Samuel George Morton (Philadelphia), 1799–1851, is best known as craniologist, paleontologist, and phthisiographer. His book on *Organic Remains* is said to be the starting-point of all systematic study of American fossils (1834).

Dr. Samuel David Gross (Philadelphia), 1805–1884, first advocated taking in the tough submucosa in the intestinal suture. Also the excision of the axillary lymphatic glands in cancer of the breast. He was one of the prime movers in the establishment of the American Surgical Association and the Philadelphia

Academy of Surgery. He published the first system of surgery to receive widespread attention outside of our country. Was the first to make notable experiments on hanging. He investigated stab wounds of the abdomen. Performed the excision of the trifacial and spinal nerves. He first suggested wiring in dislocations of the sternoclavicular and acromioclavicular. He wrote the first exhaustive treatise on *Pathological Anatomy* in English (1839). He wrote the first systematic treatise on *Foreign Bodies in the Air Passages* (1854). He made many original experiments upon the effects of manual strangulation (1836) and wounds of the abdominal walls (1834). He performed laparotomy for rupture of the bladder. He first described prostatorrhea. He first performed amputation of the ankle-joint (1851). In 1847 devised a method of enterectomy for artificial ends. Dr. Gross was preëminently a great educator, a disseminator of knowledge, standing head and shoulders above all others of his time. Since his death no other one man has attained his greatness in that line in the East. As such he fully deserved the statue erected to his memory in Washington, D. C. He contributed a number of eminent pupils and teachers to the profession, among others Dr. T. G. Richardson, of the Old University of Louisiana in New Orleans. Dr. Gross said that his greatest contribution to medicine was his son Samuel Weissel Gross.

Drs. Joseph Pancoast and D. S. Gross (Philadelphia), were the first in the world to render limbs bloodless before subjecting them to operation.

Dr. Joseph Pancoast (Philadelphia), 1805–1882, performed the first successful plastic operation for the relief of exstrophy of the bladder (1858). He was the first to practice subcutaneous division of the stricture in strangulation of hernia. He is entitled to great credit for rhinoplastic operations.

Dr. George Clark (Philadelphia): In 1806 he reported a case of uterine pregnancy in which the head of the child presented in the rectum; he passed his entire hand into the bowel and seizing the head extracted it.

Dr. Cuning Bedford (Philadelphia), 1806–1870, was the first to use a patient in gynecological teaching, taking a woman in the amphitheater and using the speculum.

Dr. William W. Gerhard, 1809–1872, and M. Rufz (Philadelphia), were the first to point out the connection of hydrocephalus with tubercles of the pia mater (1833). Differentiated typhus and typhoid (1837).

Dr. Thomas Mütter (Philadelphia), 1811–1859, was the founder of the Mütter Museum of the College of Physicians and Surgeons in Philadelphia.

Dr. Henry H. Smith (Philadelphia), 1815, was the first to treat disunited fractures by artificial limbs.

Dr. Isaac E. Taylor (Philadelphia), 1817–1889, first called attention to the causation of exophthalmos and enlargement of the thyroid by excessive lactation.

Dr. David H. Agnew (Philadelphia), 1818–1892, was the first to lacerate an opaque capsule of the lens. Also devised an operation for divergent strabismus.

Dr. Thomas G. Morton (Philadelphia), 1835–1903, was the first to ligate the subclavian artery between the two scalene muscles. He was the first to excise the perineal nerve in a case of vaginal neuralgia. He devised a ward carriage and a hospital carriage. In 1876 he first described metatarsalgia.

Dr. Joseph Leidy (Philadelphia), 1823–1891, published "Fresh Water Rhizopods of North America," which is one of our biological classics. He discovered the bacterial flora of the intestines and made the first experiments on the transplantation of malignant tumors.

Dr. Milton Antony (1789–1839) was the first to perform extensive excisions of the fifth and sixth ribs for gangrene of the lungs.

Dr. Harris (Philadelphia), in 1825, first insisted upon fixation and extension in the management of inflamed joints.

Dr. Theodore G. Wormley (Philadelphia), 1826–1897. His book on *Microchemistry of Poisons* is distinguished around the world for its thoroughness and accuracy (1867).

Dr. Deveze (Philadelphia), 1828, was the first to state that yellow fever was not contagious.

Dr. Samuel Weissel Gross (Philadelphia), 1831–1889, was the first to excise nearly two inches of the spinal accessory nerve. He performed tenotomy of the sternocleidomastoid muscle for torticollis.

Dr. Silas Weir Mitchell (Philadelphia), 1830–1914, was the first in America to investigate serpent venoms (1870–86) With Edward T. Reichert he isolated the diffusible globulins of the venoms. In 1869 he pointed out the coördinating functions of the cerebellum, and with Morris J. Lewis demonstrated that the knee-jerk can be reinforced by sensory stimulation (1886). He was the first to describe erythromelalgia or red neuralgia (1872–8). He was, with William Thomson, in 1874, the first to emphasize the importance of eye-strain as a cause of headache. "Venom of the Rattlesnake." "Respiration in Chelonia." "Discovery of the Physiological Spasm of the Larynx in Chelonia." "Effects of Reflex Paralysis." "Use of Atropin for Spastic Cases." "First Records of Ascending Neuritis." "Antagonism of Morphin and Atropin." "Injuries of Nerves and Their Consequences." "Advocated the Use of Nitrate of Amyl to Abort Epileptic Attacks." "Description of the Disease Called Erythromelalgia." "Snake Poison" (with Professor Rheinhert). "Rest Cure in Which Debilitated Patients and Nervous Wrecks Are Kept in Bed and Are Placed on Special Diets." Was among the first to show that a relation between certain derangements of the spine and swelling of the joints exists. First proved that as there is a postchoreal paralysis so also there is a postparalytic chorea.

Drs. S. Weir Mitchell and Thomson (Philadelphia) discovered the part played by errors of refraction in the production of nervous symptoms, and especially of headaches.

Dr. Jacob M. DaCosta (Philadelphia), 1833–1900, first described the irritable heart in soldiers (1862–71). He first called attention to the advantage of forced respiration on the part of the patient as an aid to the physician in diagnosing diseases of the chest (1885).

Professor Reichert (Philadelphia): Work on "Stereochemistry of Starches," etc.

Dr. E. Dyer (Pittsburg) instituted the gymnastic treatment of asthenopia.

Dr. Frank F. Maury (Philadelphia), 1840–1879, was the first to perform gastrotomy for the relief of suffering caused by organic stricture of the esophagus. In 1837 he was the first to resect the brachial plexus of nerves for the relief of neuralgia. He was the first to amputate at the shoulder-joint.

Dr. William Pepper (Philadelphia), 1843–1898, first described the changes in the bone marrow in pernicious anemia (1875).

Dr. John L. and Washington L. Atlee (Philadelphia), 1843–1883, gave a great impetus to ovariotomy.

Dr. Walter (Pittsburg). In 1857 excised portion of one or more ribs for drainage in empyema. This is also claimed for Antony in 1821 and by Stone, of New Orleans.

Dr. Pennock (Philadelphia): In 1850 was the first to adapt a rubber tube to the stethoscope.

Dr. Hugh L. Hodge: In 1864 he was the first to cause premature labor for ossification of the bones of the head. He devised the forceps that bear his name, and which were used for many years as the best. He devised Hodge's pessary.

Dr. William Hunt (Philadelphia), in 1862, introduced the use of sand-bags in the treatment of fractures.

Dr. Theophilus Parvin (Philadelphia), in 1867, first closed a ureterovaginal fistula by first turning the displaced distal extremity of the ureter into the bladder and then closing the vaginal opening.

Dr. J. G. Allen (Philadelphia), in 1872, was the first to use a very powerful galvanic current to destroy the extra-uterine pregnancy fetus.

Dr. J. Ewing Mears (Philadelphia), in 1875, was the first to open the abdomen and wash it out in cases of peritonitis.

Dr. Marks (Philadelphia), in 1893, was the first to suture a heart wound.

Dr. George Clark (Philadelphia) (deceased, no dates) was the first to operate a case of ectopic uterine pregnancy through the rectum.

Dr. Francis X. Dercum (Philadelphia) described painful obesity (1882).

Dr. Thomas Harris (Philadelphia) (deceased, no dates), was the first in this country to amputate the tongue.

Dr. Albert W. Waters (Pittsburg) (deceased, no dates) was the first to perform laparotomy for rupture of the bladder.

Dr. Joseph K. Swift (Easton) (deceased, no dates) was the first to use an extension apparatus for the treatment of fractures.

Dr. Fahnestock (Lancaster) (deceased, no dates) has also invented a tonsillotome superior to that of Physick in general use on the continent.

Dr. J. Solis Cohen (Philadelphia) contributed considerably to place the science of laryngology and rhinology upon a firm scientific basis in America and Europe. Wrote first American book on *Throat Diseases* (1872). First described vasomotor ataxia; gave equivalent of vagotonia and sympatheticotonia (1892).

Dr. Joseph Price (Philadelphia), took a prominent and original part in the treatment of pelvic inflammatory diseases, as he dictated the practice not only of America but to some extent of the entire world. He contributed considerably to the diagnosis and treatment of ectopic pregnancy.

Dr. Benjamin F. Baer (Philadelphia), ligated *en masse* the uterine and ovarian arteries preliminary to operate for hysterectomy or fibroids of the uterus.

Dr. George H. Noble (Philadelphia) has devised the liberation and displacement downward of the rectum itself, in perineal operations to make up the deficit and obviate the need of placing suture on the bowel side. He wrote the best history of fibroid tumors.

Drs. R. L. Dickinson and J. Lecomte (Philadelphia) have introduced the special direct suture of the sphincter muscles in perineal operations.

Dr. Allen J. Smith (Philadelphia): 1886, "Isolation of a New Chromogenic Bacillus, B. ceruleus (Pseudomonas Smithii Chester)." 1890, "Formulation of an Iron-hematoxylin Stain." "Suggestion of an Organogenic Influence upon Metastatic Tumors by the Organs in Which they Develop." 1894, "Recognition of Dysenteric Amebæ in Urine of a Case of Acute Cystitis." 1895, "Recognition of Ova of Hookworms in Fecal Discharge from Residents of Texas." (See article by C. M. Schaeffer.) 1901, "Description of a Previously Unreported Anaërobic Spore-forming Bacillus in Pus of Amebic Abscess of Liver." "Recognition of Hookworms in Eight Medical Students in Galveston, Texas, Establishing Endemicity of Uncinariasis in Continental United States." 1904, "Recognition of a Substance Inhibiting Coagulation of Blood in Head Glands of Uncinaria Canina." (With L. Loeb.) "Recognition of New Species of Human Parasite." "Ascaris Texana." (With R. A. Goeth). "Description of Part Taken by Cardiac Muscle in Regenerative Process in the Heart Wall." 1905, "Description of Striking Histological Changes in Thymus and Elsewhere in a Case of Congenital Hypotonia." 1908, "Proposal of New Species of Parasites in Lower Animals, as follows: Tenia paradoxuria, Cotugnia browni, Ascaris aqueillæ, Ascaris ardeæ, Oxyuris microtyphlon, Spiroptera incerta, Spiroptera (?) iguanæ, Dispharagus ardeæ." (With Herbert Fox and C. Y. White.) "Description of Peculiar Blastomycetoid Organisms in Two Cases of Nodular Parasitic Conjunctivitis." (With W. C. Posey, J. T. Carpenter, and C. M. Hosmer.) These are probably identical or closely allied to rhinosporon. 1909, "Proposal of New Species of Ciliate, Opalinopsis nucleolobata. Parasite in Liver of Coyote." (With Herbert Fox.) 1910, "Proposal of New Species of Human Endameba, Endameba Mortinatalium." (With F. D. Weidman.) "Proposal of New Species of Filarial Parasite. Filaria mitchelli, Found in Gila Monster and in Ticks." "Production of Eosinophilic Granules in Leukocytes in Vitro." (With F. S. Mullin and D. Rivas.) 1912, "Recognition of Paragonimus westermani in Wild Cats of Eastern Costal Region

of United States." (With H. Fox, F. D. Weidman, and D. Rivas.) "Recognition of the Bacteriemic Nature of Leprosy." (With D. Rivas.) 1913, "Demonstration of Transmissibility of Lepra Bacilli by Bed-bug." (With K. M. Lynch and D. Rivas.) "Demonstration of Growth Influences of Internal Secretion of Testicle (Confirmatory of Walker's Original Observations)." (With W. J. Crocker.) 1914, "Description of Inflammatory Factor in Erosion of Tissues by Aneurysm." "Recognition of Pathogenic Importance of Oral Endamebæ in Production of Pyorrhea Alveolaris, Proposal of Emetin as Remedy in Amebic Pyorrhea." (With M. T. Barrett.) "Recognition of Oral Endamebæ in Tonsils and Suggestion of Their Importance in Various Systemic Complications and in Adjacent Local Inflammations." (With W. S. Middleton and M. T. Barrett.) "Revision of Various Oral and Endamebæ, with recognition of Endameba gingivalis (Gross, 1849) and Endameba pyogenes Verdum and Bryant, 1907." (With M. T. Barrett.) He contributed considerably to the establishment of the medical department of the University of Texas at Galveston.

Dr. Jarvis (Philadelphia) first discovered the part played in nasal obstruction by enlargement of the turbinated bones. He invented the Jarvis snare.

Dr. George M. Gould (Philadelphia): All the more common symptoms of migraine are clinically caused by eye-strain and curable by scientific spectacles. "Cyclopegia as a Diagnostic Method of Proving, by the General Practitioner, whether Migraine is Due to Eye-strain or Not," was urged by me as early as 1886. If the systemic symptoms of migraine disappear with the instillation of atropin, then correct glasses will permanently cure, and as quickly. "Other Diseases Commonly Unrecognized as of Ocular Origin, such as Chorea, Neurasthenia, Dyspepsia, Cardiac Palpitation, Aphonia, Nocturnal Enuresis, Epilepsy, Insanity, Lateral Curvature of the Spine," etc., were added in the years since 1886, as usually caused by eye-strain. The frequent eye-strain origin of cataract, glaucoma, iritis, and other ocular diseases has long been advocated by me. "The Homing Instinct." The probable origin of the ability of animals

to return over long and unknown distances and routes was explained by me in 1888, on the theory that it is effected by means of a living mechanism in the brain which reacts in every part of the world, as shown by the direction and dip of the magnetic needle. "Cemented Bifocal Spectacle Lenses" were devised and descriptions published by me in 1888, and have been used all over the world since. "Why Eye-strain is such a Frequent and Powerful Cause on Reflex Systemic Diseases." "Test-cards for the Oculist, with Black Background and White Letters," were made by me in 1897. "A Mechanism of Graded Prisms, in Double Series, for Diagnosing Muscle-imbalance of the Eyes (Heterophoria), Correlated with a Method of Treating the Morbid-muscle-imbalances by Means of 'Prism-gymnastics'," were devised by me in 1895. "The Law of the Increase and Decrease of Body Weight as Productive of Changes in Ametropia," was set forth by me in 1897. "Periodical Medical Examinations" were first advised and described by me in 1900, and again in 1904, as necessary for the scientific conduct of life. "The Origins and Relations of Righteyedness and Righthandedness and of Lefteyedness and Lefthandedness" were first set forth by me in 1904. The questions relating to the eye-strain origin of the writing posture, and the lateral spinal curvature and "the Rule of the Road" were subsequently treated. "The Eye-strain Origin of the Ill-health, Invalidism, and Inefficiency of Many Men of Genius." My contributions on this subject were begun under the title, "Biographic Clinics." Six volumes of these studies include the case-histories of the lives of more than a score of the world's great literateurs, musicians, scientists, etc. "Ophthalmovascular Choke." The pathogenic factor is the crossing of the trunks of one or more retinal arteries or veins in such positions and manners that the blood circulation and supply to the macula region is lessened, and the nutrition so reduced, by the damming, that quickly fading image, amblyopia, and retinal exhaustion, result.

Dr. J. William White (Philadelphia) (deceased): "Appendicitis." This paper called attention for the first time, I believe, to

the lesser mortality in cases of appendicitis attended by diarrhea as compared with the mortality in those cases attended by constipation. "Antiseptic Surgery." This paper made public for the first time the results of a series of operative cases under the use of the double or mixed cyanide of mercury and zinc. It was an important step in the history of the development of antiseptic surgery. Lord Lister was using it in London and had given it to me confidentially. His own assistants were not at that time aware of the composition of the antiseptic he was employing. "Dislocation of the Tendon of the Long Head of the Biceps." This paper was the first systematic analysis, based on the clinical facts, of the symptoms of dislocation of the tendon of the long head of the biceps. "Use of Living Bones." This was the first time living bone was used in this country as a bond of union after excision. "Epilepsy." The first time that local topical treatment was applied directly to the affected nerve center in cases of focal or Jacksonian epilepsy. "Fractures Ununited." I think this was the first time in which metal plates were used in cases of ununited fracture. Of this I am not certain. "Influenza," paper gives clinical evidence of the contagiousness of influenza and advanced a new original theory as to the effect of the enlarged bronchial lymph nodes on the pseudopneumonic symptoms of that disease. "The Supposed Curative Effect of Operations *per se*," was certainly the first paper in which a possible curative effect resulting from operation itself was suggested and studied. "Hypertrophy of the Prostate." Was the first time that orchidectomy for enlarged prostate was suggested to the profession. "Urethral Stricture." The first paper in which attention was called to the resistance offered to the withdrawal of bulbous bougies in normal urethra by a constriction at or near the deep layer of perineal fascia. This resistance had previously led to the erroneous diagnosis of stricture in hundreds of cases. My position was demonstrated by dissection.

Dr. Charles De M. Sajous published first treatise on disorders of internal secretions (1903) with his own theory of the same.

Dr. Joseph Richardson (Philadelphia) discovered that human erythrocytes can be distinguished with certainty from the corresponding cells of nearly all lower animals.

Dr. Gwilym G. Davis (Philadelphia) was the first to start a study museum of anatomy in America.

Dr. Milton J. Rosenau (Philadelphia): Work on *Anaphylaxis;* treatise on *Hygiene.*

Philadelphia is the cradle of American Dentistry.

Dr. Ross G. Harrison (Germantown) gave final proof of the neuron theory by demonstrating ameboid outgrowth of nerve fiber-spore cells in an extravital culture (1910), which he was the first to employ.

SOUTH CAROLINA

Dr. Joseph Glover (Charleston), 1801, was the first to remove the spleen. In 1813 he was the first to perform hysterectomy (through an abdominal incision ?).

Dr. John King (Edisto Island), 1813–1893, was the first in a case of extra-uterine pregnancy to cut through the walls of the vagina, apply the forceps, and extract the child (1816).

Dr. Benjamin B. Simmons (Charleston), 1826–1891, was the first to operate for abscess of the brain.

Dr. Robert A. Kendrick (Charleston), 1826–1891, was the first to treat fractures of the lower jaw by metallic suture.

Dr. R. A. Kinloch (Charleston), in 1863, deliberately opened the belly of a wounded soldier in order to repair internal abdominal injuries arising from a penetrating gunshot wound; the patient recovered. He was the first to suture a fracture of the lower maxilla.

Dr. W. C. Norwood (deceased, no dates) ardently advocated the employment of veratrum viride.

TENNESSEE

Dr. Wm. Deadrick (Athens), 1773–1858, was the first in the world to successfully remove the lower jaw (left), 1810.

Dr. Paul F. Eve (Nashville), 1806–1878, was the first to remove a large fibroid polypus from the base of the cranium through the hard and soft palates (1836). Meigs gives him the credit of being the first American to excise the uterus *in situ*.

Dr. George R. Livermore (Memphis): Discovery that quinin administered to patients suffering from either acute or chronic gonorrhea renders their case well-nigh incurable. "Livermore Operation for Anuria." Opening through the cortex and packing the pelvis of the kidney with gauze saturated with 10 per cent. ichthyol and glycerin. "Modification of Dr. Eaton's Follicular Syringe Needle."

VERMONT

Dr. A. D. Bush (Burlington) demonstrated by scientific observations and experiments on students that the use of tobacco produces a 10 per cent. mental deficiency.

VIRGINIA

Dr. William Baynham (Virginia), 1749–1814, first operated for extra-uterine pregnancy (1790–99).

Dr. John S. D. Cullen (Richmond), 1832–1893. Experimental treatment of necrosed bones with sulphuric acid.

Dr. Hunter McGuire (Richmond): In 1868 he was the first after A. Cooper to ligate the aorta for aneurysm of the iliacs.

Dr. Eugene L. Opie (Staunton): Work on pancreatic diabetes.

Dr. J. Sheldon Horsley (Richmond): "Surgical Repair of Bloodvessels." A new operation for the end-to-end union of bloodvessels, together with a report of the experimental work that has been done to establish this operation. "Surgical Treatment of Congenital Hydrocephalus." New method for the surgical treatment of hydrocephalus which, briefly, consists in draining the lateral ventricle through a silver cannula for a period of weeks or months and afterward making the fistula communicate with the subarachnoid space. "Experimental Transplantation of Intestine." "The Results of Experimental

Transplantation of Intestine, together with a New Method of Making Intestinal Union with Sutures." "Experimental Devascularization of Intestine." Attempts were made to demonstrate that several inches of the intestine could be devascularized in a dog and its nutrition taken care of by suturing the omentum carefully around it. "A New Method of Lateral Anastomosis of Bloodvessels and an Operation for the Cure of Arteriovenous Aneurysm." "Transplantation of the Anterior Temporal Artery." Occasionally defects of the cheek are exceedingly extensive and sometimes require a lining in the mouth as well as external covering. In such instances, Dr. Horsley recommends that a flap be turned up from the neck so that the skin side will line the oral cavity, and that a flap be taken from the forehead, which is supplied by the anterior temporal artery. This artery is carefully dissected out, including some surrounding tissue, and is buried under an incision leading from the origin of the artery to the site of the defect. This incision should not be too deep, as it might then injure the branches of the facial nerve. The flap should be sutured loosely so as to permit slight oozing which relieves passive hyperemia. The cause of failure with such a flap would be having too much nutrition and not too little.

Dr. Robert B. Bean (Gala Water): Branches of the subclavian artery differ in the two sides of the body. Peculiarities of the negro brain. There are three types of forms of ears of every group of men and women in the world. The nose form likewise may be divided into three groups throughout the world. Peculiarities of Filipino types. Heredity in ear forms. Law of Alteration in Development. Eruption of the Permanent Teeth. Six types, in pairs, the two of which resemble each other, make up the morphological units of mankind. Machine to measure outlines of the heads and faces of the living.

Dr. Henry Sewall (Winchester): Work in Physiology.

WISCONSIN

Dr. Erastus B. Wolcott (Milwaukee), performed the first nephrotomy (1861).

COMMENTS

The number of States which have furnished original contributors is 30. The number of original contributors from all the States is approximately 415.

The number of original contributions furnished by all the States is approximately 645.

The number of practical contributions is approximately 90 per cent. surgical against 10 per cent. medical.

The States which have furnished the largest number of original contributors are approximately: New York, 125; Pennsylvania, 78; Massachusetts, 32; Louisiana, 26; United States Army Corps, 25; Illinois, 21; Maryland, 20; Ohio, 12.

The States which have furnished the largest original contributions are approximately: New York, 233; Pennsylvania, 230; Maryland, 84; Louisiana, 83; Massachusetts, 58; Illinois, 52; United States Army Corps, 38; Minnesota, 27; Ohio, 25; Alabama, 24; United States Public Health Service, 17; Virginia, 16; California, 11; Washington City, 11.

The original contributions which have been adopted by the profession are approximately: Alabama, 23; Arkansas, 1; California, 4; Colorado, 3; Connecticut, 11; United States Public Health Service, 18; United States Army Corps, 49; Washington City, 11; Georgia, 6; Illinois, 45; Indiana, 2; Iowa, 1; Kentucky, 5; Louisiana, 42; Maryland, 57; Massachusetts, 52; Michigan, 1; Minnesota, 22; Missouri, 4; New Hampshire, 4; New York, 148; Ohio, 20; Pennsylvania, 118; South Carolina, 6; Tennessee, 2; Vermont, 1; Virginia, 8; Wisconsin, 2.

The dual and plural claims to priority are:

"For the Removal of the Upper Jaw:" Jameson, of Maryland, 1778–1885; Wood, of New York, 1856; Wm. H. Kendrick, of Athens, Tenn., 1773–1858; Daniel L. Rogers, New York, 1856.

"For the Resection of the Lower Jaw:" Mott, of New York, 1785–1865; Wood, of New York, 1856.

"For the Removal of the Clavicle and Scapula with the Upper Extremity:" Amos Twitchell, New Hampshire, 1781–

1850; Dixi Crosby, Dartmouth, 1801–1873; Richard Bayley, New York, 1745–1801.

"For Resection of Head of Humerus:" Edward Warren, Baltimore, 1871; John Collins Warren, Boston, 1778–1856.

"For Amputation at the Shoulder-joint:" John Warren, Boston, 1753–1815; F. F. Maury, New York, 1837.

"For Amputation at Ankle-joint:" S. D. Gross, Philadelphia; John S. Billings, United States Army Corps.

"For Resection of Elbow-joint:" John Collins Warren, Boston, 1778–1856; James Mann.

"For Resection of Ribs for Empyema:" Warren Stone, of New Orleans, 1808–1892; and Walter, of Pittsburg, Pa. (No dates.)

"For the Resection of the Great Trochanter and Head of the Femur:" Willard Parker, New York, 1800–1884; Lewis A. Sayre, New York, 1820–1900; John Rhea Barton, Lancaster, Pa., 1774–1871; Henry J. Bigelow, Boston, 1818–1890.

"For the Drilling of Bones to Wire Fractures:" Daniel Brainard; J. Kearney Rodgers, New York, 1793–1851.

"For Extension Apparatus for Fractures:" Gurdon Buck, New York, 1807–1877; Joseph K. Swift, Philadelphia, (no dates); Daniel, Georgia, 1819.

"For Strips of Plaster in Fractures:" Gurdon Buck, New York, 1807–1877; J. K. Swift, Easton, Pa.; Lewis A. Sayre, New York.

"For Reduction of Dislocations by Manipulation:" Nathan Ryno Smith, New Haven, Conn., 1789–1865; Wm. W. Reid, Rochester, N. Y., 1885.

"For Section of the Masseter Muscle for Ankylosis of the Lower Jaw:" James M. Carnochan, New York, 1817–1887, and Valentine Mott, New York, 1785–1865; J. W. Schmidt, New Orleans, 1842.

"For the Treatment of Aneurysms by Compression:" Jonathan Wright, New Haven, Conn., 1789–1805; Warren Stone, New Orleans, La., 1808–1872; Jonathan Wright, Boston, Mass., 1847.

"For Animal Ligatures:" Philip Syng Physick, Philadelphia, Pa., 1768–1837; Horatio G. Jameson, Baltimore, Md., 1778–1855.

"For the Ligation of the Common Carotid in Continuity:" Mason Fitch Cogswell, Hartford, Conn., 1761–1830; Wright Post, New York, 1766–1822; Amos Twitchell, New Hampshire, 1781–1850.

"For the Simultaneous Ligation of the Common Carotid on Both Sides:" James M. Carnochan, New York, 1817–1887; Valentine Mott, New York, 1785–1865; Reuben D. Mussey, Baltimore, Md., 1780–1866 (after an interval); Levi Lane Cooper, San Francisco, Cal., 1833–1902.

"For the Ligation of the Subclavian Outside the Scalenes:" Wright Post, New York, 1766–1822; J. Kearney Rogers, New York, 1793–1851; Willard Parker, New York, 1800–1884.

"For the Ligation of the Common Iliac:" Valentine Mott, New York, 1785–1865; Gibson, Baltimore, Md., 1788–1868; Sands, New York (no dates).

"For the Ligation of the Internal Iliac:" Valentine Mott, New York, 1785–1865; Watson, New York, 1847.

"For the Ligation of the External Iliac:" Valentine Mott, New York, 1785–1865; John S. Dorsey, Philadelphia, 1783–1818.

"For the Ligation of the Femoral for Aneurysm:" Wright Post, New York, 1766–1822; James M. Carnochan, New York, 1817–1887.

"For Ligation of the Femoral to Arrest Inflammation:" Henry Fraser Campbell, Augusta, Ga., 1824–1891; Henry M. Onderbank, New York, 1813.

"For the Removal of Polypus through the Hard Palate:" Dr. John Collins Warren, Boston, 1778–1856 (?); Dr. Paul F. Eve, Tennessee.

"For Difference between Membranous Croup and Diphtheria:" Dr. Richard Bayley, New York, 1748–1801; Dr. John Ware, Boston, 1795–1864.

"For Eye-strain as a Cause of Migraine and Systemic Disturbances:" S. Weir Mitchell, Philadelphia, 1832–1914; George M. Gould, Philadelphia; John Green, St. Louis, Mo. (no dates).

"For Strabismus:" Willard Parker, New York, 1800–1884; Gibson, New York, 1842.

"For Irritable Heart of Soldiers:" S. Weir Mitchell, Philadelphia, 1833–1914; Jacob M. Da Costa, Philadelphia, 1833–1900.

"For the Radical Cure of Cancer of the Breast:" William S. Halsted, Baltimore, 1890; Willy Meyer, New York, 1894.

"For the Creation of a Vesicovaginal Fistula to Cure Chronic Cystitis:" J. Marion Sims, Ala., 1813–1883; Nathan Bozeman, Montgomery, Ala., 1825–1905.

"For Vaginal Hysterectomy:" Dubourg, Louisiana, 1830 (?); Levi Cooper Lane, California, 1833–1902; T. Gaillard Thomas, New York.

"For Reduction of Inverted Uterus by Taxis:" Dr. James P. White, Buffalo, 1811–1881; Dr. E. Noeggarath, New York.

"For Skin Grafts for Ulcer:" Dr. E. P. Hamilton, Buffalo, New York; Dr. John A. Weyth, New York.

"For Non-contagiousness of Yellow Fever:" Dr. Horatio G. Jameson, Boston, 1778–1855; Dr. Deveze, Philadelphia; Dr. Wm. Reed, United States Army Corps. Dr. Reed demonstrated it.

"For the Transmission of Cancer:" Joseph Leidy, Philadelphia; Dr. Gaylord, New York.

"For Operations on Animals:" L. E. Cooper, California; W. S. Halsted, Maryland.

The number of the most prominent original contributors still living is approximately 27: District of Columbia, 4; Illinois, 2; Louisiana, 6; Maryland, 2; Massachusetts, 2; Minnesota, 2; New York, 9; Ohio, 2.

The original contributions that are "turning points" in their line of lesser or greater magnitude are as follows:

Alabama. Dr. J. Marion Sims: "Invention of the duck-bill speculum; left lateral position; cure of vesicovaginal fistula; founder of gynecology; notes on uterine surgery; first gynecological specialist; vaginal cystotomy for chronic cystitis; amputating the cervix and covering the stump with mucous membrane; introduction of silver wire in surgery; instruments for the operation of vesicovaginal fistula; founder of Woman's Hospital.

Arkansas. Dr. Thibault: Anesthetic property of quinin and urea hydrochlorid.

California. Dr. Samuel Elias Cooper: Course in operative surgery in animals; operation for club-foot by cutting down all contracted parts. Dr. Levi Cooper Lane; simultaneous ligation of the two common carotids in the same patient.

Colorado. Dr. Clayton Parkhill: use of plates in the treatment of fractures.

Connecticut. Dr. Mason Smith Cogswell: ligated common carotid in its continuity. Dr. Nathan Smith: first dropped the pedicle after operating for ovarian cyst; use of bichloride of mercury. Dr. Jonathan Wright; cure of aneurysm by digital compression. Dr. Nathan Ryno Smith: reduction of hip-joint dislocation by manipulation; Smith's anterior splint for fractures; trephined bones for osteomyelitis; suspension in the treatment of fractures.

District of Columbia. United States Public Health Service: Dr. Henry R. Carter: Incubation of yellow fever in the mosquito. Dr. Rupert Blue: rat-proofing a whole large city. Dr. Charles W. Stiles: work on the hookworm. Anaphylaxis: standardization of diphtheria; cause and treatment of pellagra; discoveries on measles, typhus fever; establishment of the Hygienic Laboratory. *United States Army Medical Corps:* Dr. John Jones: first book on surgery and military medicine; Dr. William Beaumont; investigation on gastric digestion. Dr. James Mann: amputation at the elbow-joint. Dr. John Shaw Billings: *Index Catalogue;* Johns Hopkins Hospital, United States Census. Drs. Woodward, Smart, Otis, Huntington: *Medical and Surgical History of the War of the Rebellion.* Dr. Alfred A. Woodhull: large doses of ipecac in dysentery. Dr. George M. Sternberg: isolation of the bacillus of croupous pneumonia; *Manual and Text-book of Bacteriology by an American Writer.* Walter Reed: transmission of yellow fever by the mosquito only to a human subject. Drs. Reed, Vaughn and Shakespeare: transmission of typhoid fever by flies. Dr. William C. Gorgas: eradication of yellow fever and malarial fever in Havana and the Canal

Zone. Dr. Edward B. Vedder: beriberi is caused by a deficiency in diet; emetin is a specific remedy in dysentery. Army Medical Museum and Library are turning-points.

Georgia. Dr. Ely Fraser Campbell: knee-breast position for vaginal examinations. Dr. Robert Battey: oöphorectomy.

Illinois. Dr. Daniel Brainard: drilled bones to wire fractures. Dr. Nathan Smith Davis: founded the American Medical Association. Dr. Edmund Andrews: addition of oxygen to nitrous gas. Dr. Fenger: great educator; introduced the study of pathology in the West. Dr. Nicholas Senn: great educator of the West; treatment of fractures by ferrule; rectal insufflation of hydrogen gas; surgery of the pancreas; study on tumors. Dr. Weller Van Hook: Cure of perforation in typhoid fever. Dr. Belfield: suprapubic cystotomy for hypertrophied prostate. Dr. John B. Murphy: metallic button; end-to-end suture of arteries; proctoclysis in peritonitis; arthroplasty of joints with interposition of fat and fascia. Dr. L. L. McArthur: muscle splitting operation of the abdominal wall. Dr. Alexander H. Ferguson: closing of vesicovaginal fistula by a new method. *Journal of the American Medical Association* is a turning-point. American College of Surgeons also.

Indiana. Dr. Bobbs: cholecystotomy. Dr. John Bell: gastrotomy for the removal of foreign bodies.

Kentucky. Dr. Ephraim McDowell: ovariotomy. Dr. Walter Brashear: disarticulation at the hip-joint. Dr. Benjamin W. Dudley: trephining for epilepsy. Dr. Henry Müller: application of fluid caustics to the body of the uterus with a mop.

Louisiana. Dr. Prevost: Cesarean section in America. Dr. Dubourg: vaginal hysterectomy. Dr. Charles Luzenberg: removal of gangrenous bowel in hernia and suturing ends successfully. Dr. John Riddell: binocular microscope. Dr. Warren Stone; resection of portion of ribs for empyema; treatment of aneurysm by digital compression on the artery. Dr. Charles J. Faget: lack of correlation between the pulse and the temperature in yellow fever. Dr. H. D. Schmidt: origin of the bile ducts. Dr. T. G. Richardson: anatomy with English names.

Dr. Joseph Jones: plasmodium of malaria. Dr. J. W. Schmidt: division of masseter for ankylosis of the jaw. Dr. Andrew W. Smyth: ligation of the innominate common carotid and vertebral for subclavian aneurysm. Dr. Joseph Holt: sulphurous acid fumigation of holds of vessels. Dr. Edmond Souchon: preservation of anatomical dissections with permanent color of muscles, vessels, and organs; first and only dissection of a subclavian aneurysm of the third portion; ligation of the third portion of the axillary artery for recurrent aneurysm of the subclavian. Dr. Rudolph Matas: intrasaccular suture for aneurysm; testing of collateral circulation. Dr. Charles W. Duval: leprosy bacillus in pure culture. Dr. William H. Harris: production of pellagra in the monkey by inoculation. Dr. Maurice Couret: the fish is the host of the bacillus of leprosy. Dr. C. C. Bass and F. M. Johns: cultivation of the plasmodium of malarial fever. Dr. Ansel M. Caine: warm ether apparatus without a flame. State of Louisiana: leprosarium.

Maryland. Dr. Horatio G. Jameson: animal ligatures; removal of upper jaw. Dr. Gibson: ligation of common iliac. Dr. Edward Warren: resection of the head of the humerus. Dr. William H. Welch: discovered staphylococcus epidermidis albus; the Bacillus aërogenes capsulatus; one of the founders of the Johns Hopkins Medical School. Dr. William S. Halsted: introduced rubber gloves; research on the thyroid glands; radical operation for the cure of cancer of the breast; cure of inguinal hernia; ligation of the first portion of the subclavian artery; use of metallic bands to occlude arteries. The Johns Hopkins School of Medicine is a turning-point.

Massachusetts. Dr. John Warren: amputation at the shoulder-joint: excision of the parotid; operation for strangulated hernia. Dr. Jacob Bigelow: self-limitation of diseases. Dr. John Collins Warren: removal of pharyngeal polypi; staphylorrhaphy; paracentesis; first operation under ether anesthesia; external urethrotomy; excision of elbow-joint; foundation of the Warren Museum. Dr. John Ware: characterization of croup by a fibrous membrane. Dr. John D. Fischer: invented the

cystoscope; introduced the education of the blind in this country. Dr. Morrill Wyman: tapped the chest with a rubber tube and cannula with a suction pump attached. Dr. Henry P. Bowditch: thoracentesis. Dr. Oliver Wendell Holmes: cause of puerperal fever. Dr. Thomas G. Morton: first case of etherization for a surgical operation done in public, in a public hospital and published broadcast. Dr. N. C. Keep: use of chloroform in childbed in this country. Dr. Henry J. Bigelow: importance of the Y-ligament in the reduction of dislocations of the hip-joint. Dr. H. D. Storer: first removed the uterus for fibroids. Dr. J. P. Maynard: introduction of collodion as a surgical dressing. Dr. Henry O. Marcy: introduced Listerism in America. Dr. Theobald Smith: first experiments in immunization; parasite of tick fever; anaphylaxis; differentiation between bovine and human types of tubercle bacilli. Dr. W. F. Councilman: work on malaria. Dr. W. B. Cannon: method of observing the movements of the stomach and intestines by means of *x*-rays.

Michigan. Dr. F. G. Novy: cultivated the trypanosomes.

Minnesota. Dr. William J. Mayo: section of the vas deferens and end-to-end suture; vertical overlapping operation for the radical cure of umbilical hernia, cholecystotomy from below; radical operation for the relief of cancer of the rectum and rectosigmoid; fatty fascial flap in plastic and other operations on the kidney; transgastric excision of calloused ulcer of the posterior wall of the body of the stomach; incision for lumbar exposure of the kidney.

New Hampshire. Dr. Amos Twitchell: ligation of the common carotid in continuity; removal of clavicle and arm. Dixi Crosby: reducing dislocations of the thumb and fingers by forced extension and pressure upon the base of the dislocated bone.

New York. Dr. Wright Post: ligation of femoral for popliteal aneurysm according to the Hunterian method; ligation of common carotid in continuity; ligation of subclavian outside the scalenes. Dr. John S. Dorsey: ligation of the external iliac. Dr. Valentine Mott: ligation of the innominate; ligation of the

common iliac; ligation of external iliac; ligation of the subclavian between the scalenes; ligation of both carotids simultaneously; ligation of the right internal iliac; resection of one-half of lower jaw. Dr. J. Kearney Rodgers: wired a fractured humerus; ligation of the subclavian inside the scalenes (left); also outside the scalenes; also between the scalenes (left). Dr. Willard Parker: ligation of subclavian in its third portion; appendectomy; drainage of bladder through perineum in cases of hypertrophied growth; ligation of the subclavian (left) inside the scalenes, with the common carotid and the vertebral for subclavian aneurysm (1864); opened and drained the bladder in cystitis. Dr. Horace Green: treatment of laryngeal troubles with the mop; a foreign body can be introduced into the larynx without producing suffocation. Dr. Erastus B. Wolcott; excision of the kidney. Dr. Alonzo Clark: introduced opium treatment in peritonitis. Dr. Gurdon Buck's extension apparatus for fractures; use of strips of adhesive plaster to make extension in fractures with pulley and weights. Dr. Charles Harris: removal of the thyroid gland. Dr. Gunning S. Bedford, first clinic for women. Dr. William Detmold: perforated end of bone in ununited fractures; trephined for pus in the lateral ventricles. Dr. Dorsey in 1811 ligated the external iliac. Dr. Stearnes: ligation of internal iliac for aneurysm. Dr. James R. Wood: subperiosteal resection of lower jaw with reproduction of the bone; division of masseter. Dr. F. H. Hamilton: published a complete treatise on fractures and dislocations; skin grafting to cure ulcers. Dr. Edward R. Peaslee: drainage of peritoneal cavity for ankylosis; resection of Meckel's ganglion. Dr. William H. Van Buren: resection of a portion of each vas deferens as a substitute for castration. Dr Lewis A. Sayre: resection of the head of the femur; plaster jacket. Dr. Julius F. Miner: striped off from an ovarian cyst the extension of the pedicle instead of ligating it. Dr. Daniel L. Rogers: resection of the two upper jaws. Dr. Jameson: incision of the cervix uteri. Dr. John Rhea Barton: wired a fractured patella. Dr. S. Pomeroy White: ligation of internal iliac for gluteal aneurysm.

Dr. David L. Rogers: resection of the upper jaw. Dr. T. Gaillard Thomas: vaginal hysterectomy; use of gravitation in cases of prolapse of the funis; vaginal ovariotomy; first book on diseases of women. Dr. Wilson: laparotomy for intussusception. Dr. Jorris H. Henry: organized the ambulance service in New York. Dr. Louis Elsberg: first demonstration of the use of the laryngoscope. Dr. F. F. Maury: amputation at the shoulder-joint. Dr. Joseph O'Dwyer: intubation in place of tracheotomy; apparatus for inflating the lungs; a tube could be retained continuously in the larynx without removal for months. Dr. Charles McBurney: McBurney's point in appendicitis; hooks for the reduction of dislocated fractured heads of the humerus. Dr. Watson: ligation of the internal iliac for gluteal aneurysm. Dr. Van Buren: resection of vas deferens on both sides. Dr. George R. Fowler: decortication of lungs in case of chronic empyema. Dr. George M. Edebohls: suspension of the kidneys; decapsulization of kidney. Dr. W. W. Reid: first reduction of dislocation of hip by manipulation. Dr. Frank Hartley: intracranial neurectomy for the second and third divisions of the fifth nerve for neuralgia. Dr. Van Ingen: elevation of the foot of the bed for counter-extension in fractures. Dr. George M. Beard: introduction of the concept of neurasthenia. Dr. Newman: shortening of round ligaments. Dr. Outerbridge: speculum for dilatation of the cervix uteri. Dr. Gunning: interdental splint. Dr. Sabine: built a nose from a phalanx. Dr. John Baird: laparotomy for extra-uterine pregnancy. Dr. J. P. Bachelder: compressed sponges. Dr. Sass: treatment of laryngeal troubles by the spray method. Dr. John Ball: rapid and forcible dilatation of the cervix uteri with instruments. Dr. Ernest Krackowiser: demonstration of the vocal cords. Dr. Gouley: filiform whalebone guide, tunnelled catheter staff, beaked bistoury. Dr. Thomas Addis Emmett: perineal and cervix operations. Dr. Clinton Wagner: thyrotomy. Dr. Rufus P. Lincoln: removal of intrapharyngeal fibromata through the internal passages instead of after extensive preliminary operation. Dr. F. H. Bosworth: pioneer work in rhin-

ology. Dr. John R. French: photographing human larynx. Dr. Austin Flint: variations of pitch elicited by percussion; demonstrated the heat production to oxidation of carbon and hydrogen. Dr. Robert F. Weir: fracture of malar bone. Dr. Robert T. Morris: wick drain. Dr. John A. Wyeth: ligation of the external carotid artery for lesions of its branches instead of ligating the common carotid; bloodless operation of the hip-joint and shoulder; arterial occlusion by cell proliferation after ligation in continuity; founding of the first Polyclinic School for Post-Graduates in America. Dr. Lewis A. Stimson: ligation of the uterine and ovarian arteries preliminary to hysterectomy for fibroids and other affections of the uterus. Dr. Robert Abbe: treatment of strictures of the esophagus by the string method; operation for trigger finger. Dr. Leonard Corning: local anesthesia with cocaine; spinal analgesia applied to animals. Dr. J. Riddle Goffe: covering the stump with peritoneal flaps after supra-vaginal hysterectomy. Dr. Emil Noeggerath: reduction of the inverted uterus by digital compression of the horns; female pelvic inflammations are due to infection by gonococci transmitted by the male. Dr. Willy Meyer: radical operation for cancer of the breast. Dr. Simon Flexner: injection of the antimeningococci into the subdural space; discovered with Dr. Noguchi the germ of anterior poliomyelitis. Dr. Jacques Loeb: produced fecundation of the ova of some fish without the intervention of spermatozoa. Dr. Peyton Rous: transmission of a malignant growth. Dr. Meltzer: intratracheal insufflation. Dr. Alexis Carrel: preservation of life in tissues and organs outside of the body; transplantation of tissues and organs from one subject to another; thyroid gland and vascular surgery. The Rockefeller Institute is a decided turning-point. Drs. H. R. Gaylord and G. H. A. Claws inoculated rats and mice with cancer. Dr. E. L. Trudeau: open-air treatment of tuberculosis. The Carnegie foundation for the advancement of teaching is a decided turning-point.

Ohio. Dr. Marmaduke B. Wright: bimanual version. Dr. George W. Crile: anoci-association; the emotions; block excision

of lymphatic gland-bearing tissues of the neck; retrolaryngeal packing prior to removal of larynx.

Pennsylvania. Dr. John Morgan and Dr. William Shippen, Jr.: foundation of the medical department of the University of Pennsylvania; Wistar Institute of Anatomy and Biology. Dr. Thomas C. James: induction of premature labor for contracted pelvis. Dr. Philip Syng Physick: animal ligatures; tonsillotome; puncture of head for hydrocephalus; use of stomach pump; seton between the ends of ununited fractures; internal urethrotomy; cure of artificial anus. Dr. N. Chapman: first book on *Therapeutics and Internal Medicine.* Dr. William Gibson: strabismus. Dr. Horatio Gates Jameson: resection of superior maxilla. Dr. A. H. Stevens: abnormalities of equilibrium of the ocular muscular apparatus. Dr. Charles D. Meigs: embolism in childbed. Dr. Charles McClelland: resection of lower jaw in front of the two angles. Dr. Wm. E. Horner: removal of upper maxilla without incision in the cheek. Dr. Samuel D. Gross: taking the submucosa in the intestinal suture; removal of axillary glands in cancer of the breast; founder of American Surgical Association; first book on Pathology in the English language; amputation of ankle-joint; operation for artificial anus. Dr. Joseph Pancoast and Dr. S. D. Gross: limbs rendered bloodless before subjecting them to operation. Dr. Joseph Pancoast: plastic for atrophy of bladder. Dr. John Rhea Barton: Barton's fracture of the radius. Dr. William W. Gerhard and Dr. M. Rufz: connection of hydrocephalus with tubercles of the pia mater; differentiation between typhus and typhoid fever. Dr. Thomas G. Morton: ligation of subclavian between the two scalenes. Dr. Joseph Leidy: bacterial flora of the intestines; first transplantation of malignant tumors. Dr. Harris: fixation and extension in management of inflamed joints. Dr. Deveze: non-contagiousness of yellow fever. Dr. Samuel W. Gross: tenotomy of the sternomastoid for torticollis. Dr. S. Weir Mitchell: serpent venoms; eye-strain as cause of headaches; antagonism of morphin and atrophin; nitrite of amyl to abort epileptic attacks; rest cure. Dr. Jacob M. DaCosta: irritable

heart; forced respiration. Dr. D. Dyer: gymnastic treatment of asthenopia. Dr. Frank J. Maury: gastrotomy for the relief of suffering caused by organic stricture of the esophagus. Dr. Pennock: rubber tube to stethoscope. Dr. Walter: resection of portions for drainage in empyema. Dr. Hunt: sand-bags in the treatment of fractures. Dr. Hugh L. Hodge: premature labor for ossification of the bones of the head; forceps; pessary. Dr. Theophilus Parvin: closing of ureterovaginal fistula by first turning the displaced distal extremity of the ureter into the bladder and then closing the vaginal opening. Dr. J. Ewing Mears: laparotomy to wash out the abdomen in cases of peritonitis. Dr. Thomas G. Morton: metatarsalgia. Dr. Marks: suture of heart wound. Dr. Thomas Harris: amputation of the tongue. Dr. Albert W. Waters: laparotomy for rupture of bladder. Dr. Joseph K. Swift: extension apparatus for fractures. Dr. Benjamin Bauer: ligation *en masse* of the uterine and ovarian arteries preliminary to operation for hysterectomy. Drs. R. L. Dickinson and J. Lecomte: special direct suture of the sphincter muscle in perineal operations. Dr. Jarvis: hypertrophy of the turbinated bones. Dr. George M. Gould: eye-strain cause of migraine and systemic disturbances; cemented bifocal spectacle lenses; test cards; graded prisms. Dr. J. William White: use of living bones. Dr. Joseph Richardson: human erythrocytes can be distinguished with certainty from those of the lower animals. Dr. Gwilym G. Davis: study museum of Anatomy. Philadelphia is the cradle of American dentistry.

South Carolina. Dr. Joseph Glover: removal of the spleen; hysterectomy (abdominal). Dr. Benjamin B. Simmons: abscess of the brain. Dr. R. A. Kinlock: laparotomy and intestinal suture.

Tennessee. Dr. William H. Deadrick: removal of lower jaw. Dr. P. F. Eve: removal of large polypi from the base of the cranium through the hard and soft palates.

Vermont. Dr. A. D. Bush: the use of tobacco produces a 10 per cent. mental deficiency.

Virginia. Dr. Hunter McGuire: ligation of the aorta for aneurysm of the iliacs.

Wisconsin. Dr. Erastus B. Wolcott: first nephrotomy.

The total number of turning-points is 323: Alabama, 9; Arkansas, 1; California, 3; Colorado, 1; Connecticut, 8; District of Columbia, 1; United States Public Health Service, 10; United States Army Corps, 15; Georgia, 2; Illinois, 18; Indiana, 2; Kentucky, 4; Louisiana, 21; Maryland, 15; Massachusetts, 28; Michigan, 1; Minnesota, 6; New Hampshire, 2; New York, 110; Ohio, 4; Pennsylvania, 58; South Carolina, 3; Tennessee, 2; Vermont, 1; Wisconsin, 1; in a total of 23 States.

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THE SAFE ELIMINATION OF THE COLON FOR THE RELIEF OF UNCONTROLLABLE INTESTINAL STASIS

By A. J. OCHSNER, M.D.
CHICAGO

After eliminating the very large number of patients suffering from intestinal stasis who are primarily neurotics and suffer from intestinal stasis only secondarily, who are practically never benefited by surgical treatment, and the still larger number of cases suffering from intestinal stasis who can be permanently relieved from this condition by exercise, hygiene, dietetic and carefully planned, long-continued medical treatment, there still remains a very small class of cases, in our experience comprising less than 5 per cent. of all cases suffering from intestinal stasis, which constitute a third and distinct class whose members are not primarily neurotics and who are in so intractable a condition of intestinal stasis that they cannot obtain relief from non-surgical measures.

The members of the first class described above should not be subjected to surgical treatment because this treatment does them no good. Neither should this treatment be employed in members of the second class because they do not need it.

Surgical treatment should, consequently, be limited to the third class of cases described above, and these should be given the benefits of surgical treatment, provided this does not involve too much danger to life and insures permanent relief without troublesome complications. Most of the early methods employed failed in at least one of these respects, although the chief fault

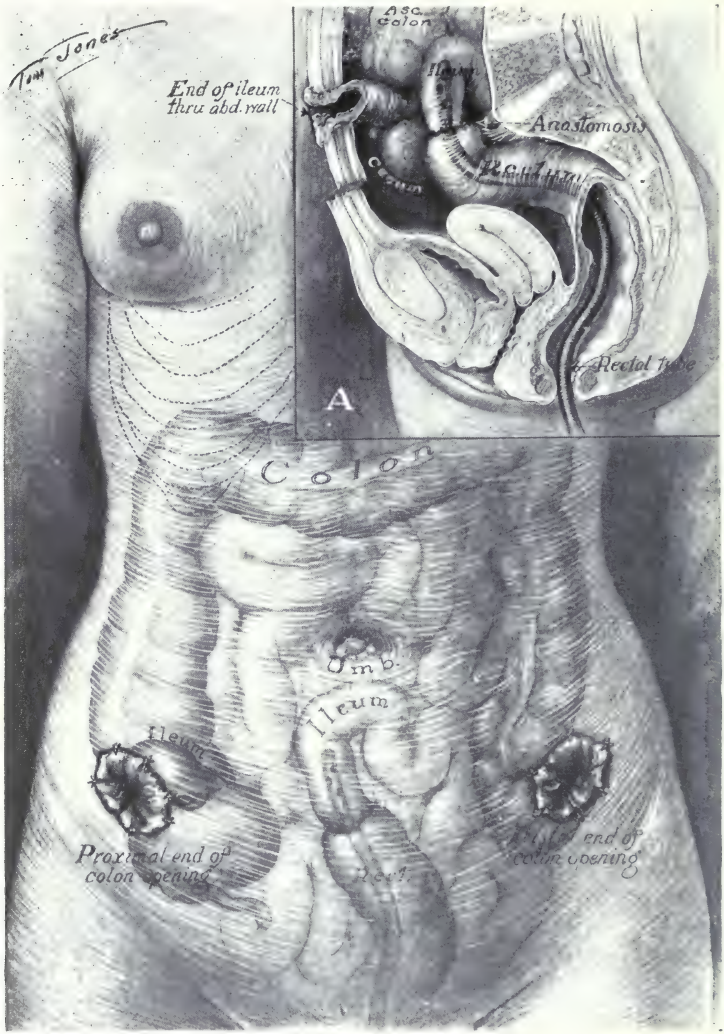
lay in the fact that these methods were applied very largely to patients belonging to groups one and two in the above classification.

The method first advocated by Lane,[1] consisting of a simple ileocolostomy, was especially unsatisfactory because of the tendency of fecal material backing up in the colon in a proximal direction from the enterostomy opening, filling the descending, the transverse, and even the ascending colon and sometimes the cecum.

A partial closure of the sigmoid above the enterostomy opening frequently failed to relieve the condition. The plan suggested by W. J. Mayo,[2] of excising the cecum and ascending colon and preserving the descending colon proved satisfactory only in a small number of cases. The plan of excising the entire colon down to the sigmoid flexure, or including a portion of this, advocated by Lane and many of his followers in severe cases, increased the danger of the operation enormously, except in the hands of surgeons of very great skill. It also deprived the patient of the omentum. It would seem that the loss of this important organ should not be underestimated. In order to overcome this objection we employed a method, with great satisfaction in a number of cases, in which we severed the ileum 20 cm. from its entrance into the cecum, implanted the proximal end into the side of the lower end of the sigmoid flexure and brought out the distal end of the ileum through a small McBurney incision directly in front of the cecum.[3] Through this opening the colon was carefully flushed, at first daily and later less frequently. This operation was fully as safe as the simple ileocolostomy, and had the advantage of enabling the patient absolutely to prevent the accumulation and stasis of feces in the colon.

In cases in which the tendency for the accumulation of feces seemed extreme, however, we have, during the past two years, in two cases, made use of an additional step which was suggested to me by Dr. William J. Gillette, of Toledo, Ohio, and which seems to contain more good features than any one of the other

methods we have employed. The illustration clearly shows all of the features of this operation.



The ileum is severed at the point which makes the anastomosis of its proximal end to the sigmoid flexure of the colon most convenient. The distal end is then carried out through a

buttonhole in the abdominal wall immediately in front of the cecum, opposite McBurney's point, the fibers of the transversalis, internal oblique, and external oblique abdominal muscles being separated without being cut, in order that they may form a kind of sphincter to close the open end of the protruding intestine, which is held in position by means of a few fine silk sutures.

The sigmoid flexure of the colon is then severed at a point, leaving the distal end in the best condition to make an anastomosis with the proximal end of the ileum.

In case an end-to-end anastomosis is made it is important to turn the two ends in such a position as to prevent having the mesentery of the ileum opposite that of the sigmoid, because of the danger of leakage at that point.

An end-to-side anastomosis of the ileum into the sigmoid is very satisfactory. In case both intestinal ends are closed in order to make a side-to-side anastomosis it is important to make the opening in the ileum near its distal end and to prevent the forming of a pouch or diverticulum beyond this point, as has been pointed out by N. M. Percy,[4] by attaching the very end of the stump of the ileum to the side of the sigmoid.

A fairly soft-rubber tube 1 cm. in diameter should be carried up through the rectum and sigmoid beyond the anastomosis opening for a distance of 10 cm. into the ileum, as recommended by Lane, in order that there may be no accumulation of gas in the ileum proximal to the anastomosis opening, as shown in the illustration, and in order that normal salt solution may be introduced directly after completing the operation by means of the Murphy drip. The sphincter ani muscle should be dilated very gently, but very thoroughly, in order to increase the comfort of the patient during convalescence.

The proximal end of the sigmoid flexure of the colon is then passed through an opening in the abdominal wall exactly opposite the opening on the right side, through which the distal end of the ileum was passed during the first part of the operation. The end is permitted to project for a distance of 1 cm., and is

fastened in place by means of a few fine silk sutures. This leaves the ascending, transverse, and descending colon and the omentum in their normal relations, able to protect the other intra-abdominal structures by their presence, while they are entirely eliminated so far as they can have any influence upon the causation of uncontrollable intestinal stasis. The slight amount of mucus which may accumulate in the colon can be washed out readily by inserting the nozzle of a syringe into the distal end of the ileum projecting through the abdominal wall. The condition causes the patient practically no annoyance, and is not offensive to himself or to others.

Since we have employed this method I have been anxious to try it in a case of Hirschprung's disease, but so far I have not had an opportunity. It would surely reduce the danger of this operation in which the mortality, according to Picqué,[5] amounts to nearly 40 per cent.

The total number of cases in which surgical interference for the relief of intestinal stasis is indicated is so small that we have not had an opportunity to use this method in a sufficiently large number to justify conclusions, but it seems to possess sufficiently valuable qualities to make the method worthy of consideration.

The principle involved in this operation is, of course, the same that has been constantly in use in many operations upon the colon. A. E. Rokey[6] suggested appendicostomy in connection with Lane's operation for the same purpose.

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4. Percy, N. M.: New Manual of Surgery, fourth edition, p. 327.
5. Picqué: Presse médicale, January 15, 1913.
6. Rokey, A. E.: Annals of Surgery, May, 1911.

A STUDY OF THE RECTOSIGMOID

By WILLIAM J. MAYO, M.D.
ROCHESTER, MINN.

The rectosigmoid, the narrowest part of the large intestine, consists of three and a half inches of the intestinal tract, which includes the terminal two inches of the sigmoid and the proximal one and a half inches of the rectum. It is a definite mechanism which retards the fecal current and prevents continuous progress of the intestinal contents into the rectum. The examination of a large number of men for army service demonstrates that in the adult the normal rectum does not retain feces for any legnth of time; and when it does, such action is artificial and pathological. With the exception of the pyloric end of the stomach and the first portion of the duodenum the rectosigmoid is more frequently diseased than any corresponding portion of the gastro-intestinal tract.

In the older anatomies the terminal two inches of the sigmoid was often, if not usually, called the first portion of the rectum because of certain anatomical peculiarities which rendered it difficult to say with certainty whether it was sigmoid or rectum. Following the researches of Treves and Jonnesco it was definitely concluded that this portion of the intestinal tract was part of the sigmoid, and it is so designated in all of our later anatomies. The rectum proper begins at the middle of the third sacral vertebra and, anatomically speaking, ends at the level of the apex of the prostate in the male and at the upper level of the perineal body in the female, sites which mark the beginning of the so-called second portion of the rectum or, more correctly, the anal canal.

The anal canal has its origin in the proctodeum or skin infold. It is lined with pavement epithelium, has no mucous glands, and is in no way a part of the rectum, but is rather a retentive mechanism extraordinarily well adapted to temporary rectal retention. The anal canal is about 3 cm. in length, and passes upward and forward at such an angle in relation to the musculature of the rectum as to relieve the strain on the sphincter muscles. This valve type of mechanism is exhibited in the compression of the ureter in the wall of the bladder and of the common duct in the wall of the duodenum. Its most important artificial imitation is shown in the brilliant work of Coffey, which has made transplantation of the ureters to the large intestine an operation of safety and precision.

The rectum is therefore a single organ averaging 11 cm. in length, with a protective sigmoid mechanism above and the sphincter apparatus of the anal canal below. The upper of the two left valves of Houston, which is nearly always discernible, although sometimes rudimentary, lies just below the inferior margin of the terminal sigmoid constriction. The lower left valve of Houston lies below the level of the peritoneum, while the single large right valve, which is nearly always present, projects well across the lumen of the rectum near the midpoint.

The ampula of the rectum may be described as the sacculated portion lying between the anal canal and the lower left valve of Houston. The middle portion of the rectum ends above at the right valve while the upper rectum extends to the sigmoid at the upper left valve. The index finger of the average examining hand, with the anal canal forcibly elevated, can reach to, and often a little above, the right valve of Houston, but not to the rectosigmoid juncture (Fig. 1).

This interpretation of the anatomy of the rectum is in harmony with its embryological origin. The rectum proper is derived from the cloaca, a highly differentiated part of the hind gut, from which also the bladder is derived. Definite anatomical changes are to be found in the epithelial layers of the mucous membrane at the rectosigmoid juncture, and possibly a tissue weakness worthy of note.

The terminal two inches of the sigmoid (Fig. 1) has considerable resemblance to the lower rectum just above the anal canal.

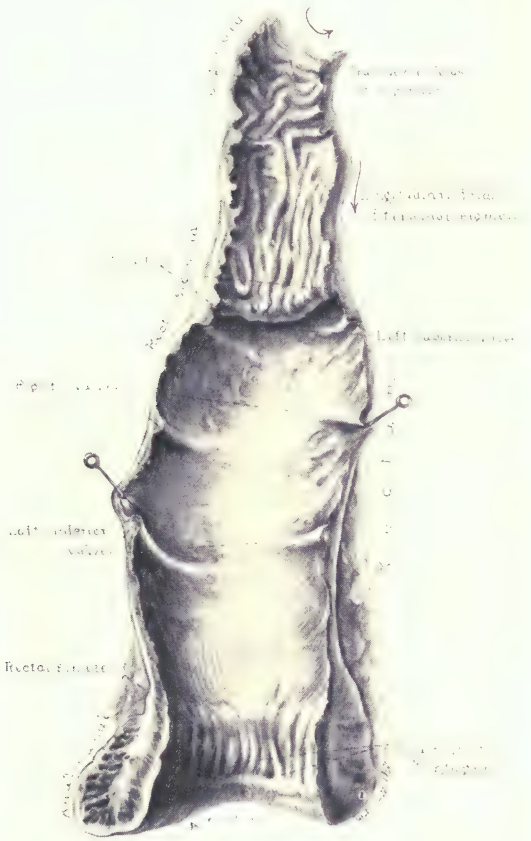

FIG. 1.—Terminal sigmoid, rectum, and anal canal from inside.

The more or less circular folds of the mucous membrane of the sigmoid here take on a longitudinal arrangement with much the appearance of the columns of Morgagni and the rectal sinuses,

and end in a rudimentary sphincter apparatus at the very beginning of the rectum. This hint of a sigmoid sphincter at the rectosigmoid union forms a well-marked resisting constriction to the readily dilatable sigmoid above and the rectum below (Jonnesco, Markel).

Examination shows that this circular band at the termination of the sigmoid contains considerable non-striated muscle fiber (Figs. 1 and 2). Clinically there is often seen through the proctoscope, when the patient strains during examination, a tendency of the movable sigmoid to project through this muscle band as a slight intussusception into the fixed rectum. Tumors in the terminal sigmoid are not infrequently intussuscepted into the rectum, giving the diagnostician the erroneous impression on digital examination that they are rectal.

Through the kindness and with the aid of Dr. C. M. Jackson, head of the department of anatomy, University of Minnesota, Dr. T. B. Reeves, at my request, carefully dissected the rectum in 46 cadavers. The terminal sigmoid constriction (Figs. 1 and 2) was found in 80 per cent., and in 2 of the 46 it amounted to a definite narrowing which reduced the caliber of the rectosigmoid juncture to a considerable extent. This narrowing seems to have attracted little attention from surgeons, and in the large majority of cases it is so slight as to be readily overlooked (Fig. 1).

Examination of the rectosigmoid, that is, the part of the rectum which lies above the right valve of Houston and the terminal two inches of the sigmoid from the inside shows not only those definite changes in color and arrangement of the mucous membrane which characterize the rectum and sigmoid respectively, but also in a high percentage of subjects the rudiments of the terminal sigmoid sphincter which defines the two organs. Examination of the outside of the rectosigmoid discloses prominent features of identification: (1) The rectum has no mesentery; (2) the longitudinal muscle bands of the sigmoid spread out, making a complete longitudinal layer for the rectum; (3) the superior rectal artery divides into the right and left branches

at the origin of the rectum; (4) the absence of epiploic tags, which are found on the sigmoid to its end (Fig. 2).

The impression is gained that ordinarily the rectosigmoid is an arrangement for retention of contents in the sigmoid proper

FIG. 2.—Terminal sigmoid, rectum and anal canal seen from behind, with relation to bony pelvis.

and that under certain circumstances the controlling mechanism may subject the parts to undue stress.

The rectosigmoid apparatus is controlled by the pelvic plexus of nerves, which is made up of a variable number of sympathetic ganglia joined from above by spinal nerves from the lumbar

region and from below by spinal nerves from the sacral region. From the lower part of the pelvic plexus nerves can be traced into the rectosigmoid region and the rectum. The inferior mesenteric plexus, containing a variable number of sympathetic ganglia, follows along the course of the superior hemorrhoidal artery and helps to supply the rectosigmoid and the upper part of the rectum. According to Langley and others the nerves

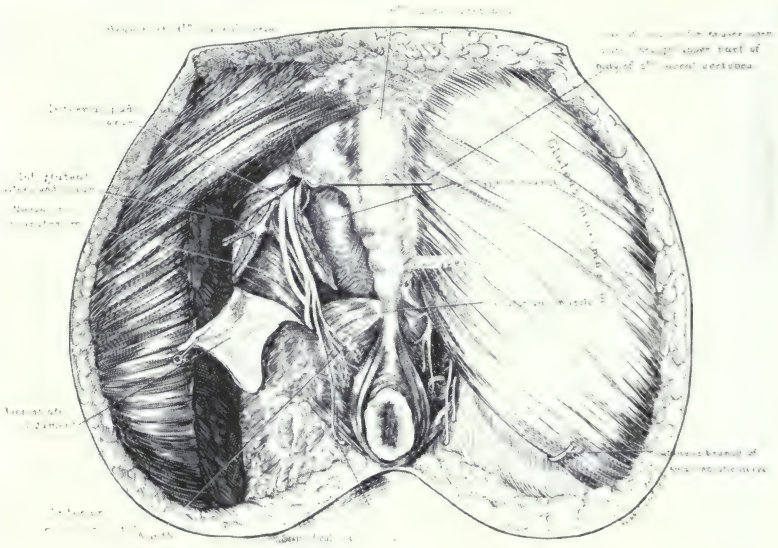

FIG. 3.—The superficial anatomy of the sacral, coccygeal, and anal region. Note the notch which marks the line of bone section just below the fifth sacral foramina.

derived through the hypogastric plexus are inhibitory in action, while those from the spinal and sacral nerves are motor (Fig. 3).

In addition to the nerves mentioned the smooth muscle fibers which compose the musculature of the rectosigmoid, like all non-striated muscle fibers, have the power of originating contraction, and, according to Keigh, these impulses are collected in certain neuromuscular nodes and correlated. Failure of coördination results in a most curious and interesting pathological

phnenomenon: the so-called idiopathic dilatation of the colon or Hirschsprung's disease. A number of cases of this condition have been recognized since the attention of American surgeons was called to it by Finney. The disease is similar in origin to cardiospasm at the cardiac orifice, pylorospasm at the pylorus, and stasis at the ileocecal valve.

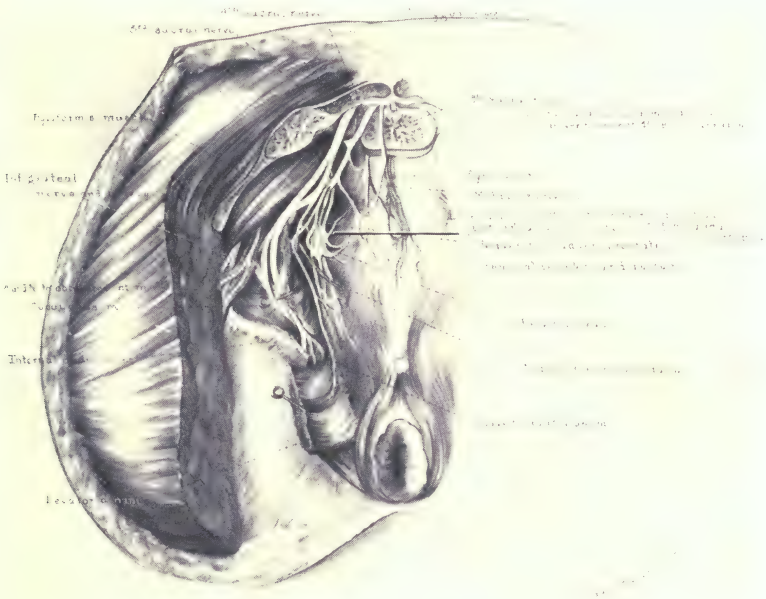

FIG. 4.—The deeper anatomy of the region shown in Fig. 3 as exposed by section through the third sacral vertebra as first advised for the Kraske operation. This line of section is liable to produce extensive injuries to important nerves and predisposes to sacral hernia. Line of section through the fifth sacral vertebra gives sufficient exposure and no important nerves are injured.

The terminal sigmoid, as held by its mesentery, has considerable play and curves from its rectal attachment. The longitudinal muscle bands are well developed, and by spreading out grasp the entire rectum. It is probable that contraction of these bands from the fixed point of the rectum under proper stimula-

tion enables the sigmoid to straighten and pour its contents into the rectum, while under ordinary circumstances the angulation is coeffective in retention. Investigation shows that the emptying of the large intestine from the splenic flexure is accomplished largely by siphonage. The hardened head of the fecal current rests at the rectosigmoid, and the siphon is established when this mass, which can be compared to the piston of a syringe, moves onward.

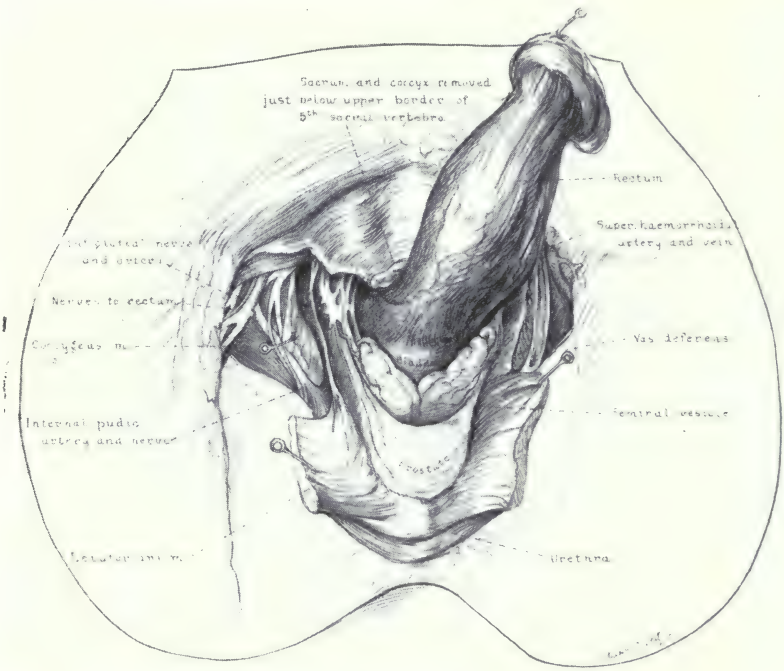

FIG. 5.—Anatomy anterior to rectum in the male as seen in Kraske's operation.

From the foregoing it may be seen that the rectosigmoid is a distinct anatomical region, which possesses some of the characteristics of the pylorus and of the ileocecal mechanism, and that it depends on its anatomical arrangement for function. The difficulty of guiding tubes and instruments from the rectum into the sigmoid is due to the rectosigmoid mechanism and makes futile the use of the so-called colonic tube in which the passage

of a length of tube out of sight into the rectum where it remains coiled leads to the supposition that it has passed into the sigmoid. Single or several polypi which are so frequently found in the ampulla of the rectum, and which, on straining, are grasped in the sphincter apparatus and rendered pedunculated, have their counterpart in the single or, at most, two or three polypi, which are so often found in the terminal sigmoid, and which for the same reasons have become pedunculated into the rectum.

Experienced observers have called attention to the frequency of infections, polypi, diverticula and various other pathological conditions in the terminal sigmoid. With the exception of the pyloric end of the stomach, carcinoma is to be found more frequently in this three and a half inches than in any corresponding part of the gastro-intestinal tract. In an investigation of the last one hundred specimens of cancer of the rectum and rectosigmoid removed consecutively at St. Mary's Hospital, Rochester, Minnesota, it was found that 28 were located in the rectosigmoid juncture, extending as much onto the rectal as onto the sigmoid side, 21 involved the juncture but extended more onto the rectal than onto the sigmoid side, 14 involved the juncture but extended more onto the sigmoid than onto the rectal side. Thus 63 per cent. involved the rectosigmoid, 30 per cent. the rectum only, and 7 per cent. the anal canal.

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DISCUSSION

Dr. Arpad G. Gerster, New York City:

I rise to the discussion of this paper at the request of my friend, Dr. Mayo. First of all we owe a debt of gratitude to Dr. Mayo for having presented to us in such a wonderfully brief, concise and clear manner, the present status of the knowledge of the large intestine, calling attention to the presence of an important sphincteric apparatus in the region where sigmoid flexure and rectum meet. The second part that is important in his paper is the statistical study based both on the examination of the cadaver and the result of a series of operations at the Mayo Clinic. Permit me to say a few words regarding statistics. It was imagined and still is imagined that the larger your pile of statistics, the more reliable its deductions; but that is a great mistake. People have come to the knowledge that the bigger the pile of statistics collected from various and diverse sources, the less trustworthy its conclusions. The reason is plain. Statistics are only valuable when they are collected by one man or under one man's supervision, and in conditions, laid down under a comprehensive principle and carried through consistently. If you take statistics from different sources you will find some of them unsatisfactory, others of them entirely worthless. These statistics presented by Dr. Mayo are valuable because they have all been collected under his own direction, hence are reliable, precise and complete. The statement that in 63 per cent. of these cases the rectosigmoid was involved in carcinoma, in 30 per cent. the rectum, and 7 per cent. the anal canal, is valuable. No new fact is stated thereby, only the well-known rule is confirmed, that all the narrowing or straits in the gastro-intestinal tract are favorite sites for carcinoma. Not only carcinoma but infectious diseases also find lodgment there more easily than elsewhere, and here certain traumatisms are unavoidable. The traumatisms to which these narrow parts are subjected are mainly mechanical; but they are also bacterial, irritation being composed of biochemical and mechanical elements. To say that this is the cause of carcinoma would be going too far; because every man has these narrowings and yet not every man gets carcinoma. There must therefore be some element, some essential which affects the narrowings, our ignorance of which we mantle by the unmeaning term of "disposition," a vague expression which is used to construe a convenient, but empty phrase. What the tangible essence of this "*disposition*" is will have to be shown by the laboratory. I shall conclude my

remarks by saying that I personally feel much indebted to Dr. Mayo for having in such an admirable way called our attention to these important matters.

Dr. Joseph C. Bloodgood, Baltimore:

I believe that Dr. Mayo has had a larger experience with the operative treatment of cancer in this region than any other man either living or dead. So far as I can see from our present technic the surgery of the stomach and intestine is apt to become easier from time to time, yet I see no hope from our present experience in the surgery of this portion of the colon that technic is to make it more easy. I trust Dr. Mayo will help us to decide this tremendous problem of how to overcome such enormous mortality in this region.

Dr. William J. Mayo (closing):

Because we were dissatisfied with the various methods of resection we were using I was led to undertake this study of the rectosigmoid, hoping thereby that we would be enabled to deal more efficiently and safely with cancers in this situation. Our mortality had been high and the functional results in many of the cases, by reason of permanent colostomy, abdominal and sacral, had been poor. However, we have a number of patients operated on who are alive and well now more than five years since operation. We no longer look on fixation of an ulcerating growth as necessarily a bar to operation, unless the process involves the mucosa of the bladder, as shown by the cystoscope, or other organs which preclude operation. We have not hesitated to remove the uterus, both ovaries and tubes, and a considerable portion of the vagina in the female, the prostate and both seminal vesicles, and part of the bladder in the male, and the results encourage us to continue doing so.

But we must not be too largely influenced by mortality or percentages of cures. Operability is the real guide. For instance, I found that when our operability was 25 per cent., that is, 25 per cent. of all the patients who presented themselves at the clinic for examination—some hopeless, others who had been operated on previously, explorations, palliations and resections—the mortality of radical operations was under 5 per cent. and the percentage of cures was above 50 per cent. When the operability was increased to 50 per cent. the mortality in the next 25 per cent. was doubled and the percentage of cures was brought down to the neighborhood of 35 per cent. We finally succeeded in increasing the operability to 71.8 per cent. This last increase of 21.8 per cent. gave a mortality of 30

per cent., and the percentage of cures was reduced to 22 per cent., but out of each 100 patients presenting themselves at the clinic, there were 27 alive and cured more than five years, instead of 13 of 100 as when our mortality was low and the percentage of cure high. The two-stage or more operations are valuable in a certain group of cases, and they reduce the mortality, but in studying such cases the mortality should be considered as case mortality, not as operative mortality. If each patient is operated on two, three, or four times, he gets well after each operation, thus giving a low operative mortality, but if he dies, he dies but once. Looked on as a patient, however, he has had a number of operations with a great deal of disability, and the mortality rate may not have been greatly changed over what it would have been under a one-stage operation.

RESECTION OF THE LARGE BOWEL AT THE RECTOSIGMOIDAL JUNCTION

By STANLEY STILLMAN, M.D.
SAN FRANCISCO, CAL.

Resection of portions of the large bowel, or even the whole of it, is accomplished today without particular difficulty and in accordance with well-recognized principles: the same is true of the rectum, but it is occasionally one's fortune or misfortune to encounter an obstruction or disease of the large bowel which involves both the rectum and the sigmoid and for which resection is required. It is not necessary to enlarge on the technical difficulties encountered in performing a resection of this portion of the bowel and making an anastomosis below the brim of the pelvis when the bowels are distended as the result of complete or incomplete obstruction. They are such, however, that one usually resorts to colostomy at once and reserves the resection and anastomosis for a later operation. Yet this very distention of the bowel may be utilized except in extreme cases and both resection and anastomosis done in the often limited time permitted by the patient's condition.

In most cases carcinoma in the above situation is the condition necessitating the operation, but I have been obliged to do it for perforation of the sigmoid at this point, the result of a false diverticulitis, and another time for obstruction following dense adhesions at this point, the result of a previous pelvic operation.

Whether the method, to be described, of dealing with it has the merit of novelty or not, I am unaware, but it has proven singularly successful in my hands, and if it has not this merit it

certainly has others to which I wish to subscribe. It is practically the same method that I have used successfully a few times in cases of cancer of the rectum proper, when the external sphincter could be preserved.

In those cases in which the location of the growth or obstruction can be determined beforehand, and in which the obstruction is practically complete, the sphincter should be stretched and the rectum thoroughly washed out and lightly packed with a strip of gauze before the abdomen is opened. In other cases this should not be done till after the abdomen has been opened and a clamp applied to the sigmoid above the point of section after milking back the contents.

The next step is the section of the sigmoid above the obstruction and invagination of the proximal end by means of a purse-string suture of Pagenstecher, the ends of which are left long, after which the clamp is removed, and the sigmoid mobilized sufficiently by ligation of its mesentery if necessary, to reach well below the line of section of the rectum. It is then kept out of the way by pads till the resection of the involved bowel is completed. The section through the rectum is made after steadying and keeping apart its walls by means of several stay sutures passed through its peritoneal coat below and close to the line of section. With the proper distribution of pads and the exercise of a little care and ingenuity in controlling the escape of blood and intestinal contents, both these lines of section and the removal of the involved bowel can be accomplished with a minimum of soiling. The packing is now withdrawn from the rectum through the anus, and if desired, several strips may be drawn through the anus from above by attaching them together with sutures. After hemorrhage is arrested the exposed mucous membrane of the upper part of the rectum is wiped clean with moist sponges and painted with iodin for a distance of one or two inches, being held open all this time by the traction sutures.

With a little care and a pair of Mayo scissors and forceps, the mucosa can now be removed for an inch or more down the rectum, and the hemorrhage arrested without the use

of ligatures, if possible. The ends of the purse-string suture closing the end of the sigmoid is now attached to a thread previously fastened to the last strip of gauze drawn down through the anus and by traction on this by an assistant aided by a hand in the pelvis, the sigmoid is drawn well into the rectum. The suture is passed through the skin outside the anus and tied so as to fix the end of the sigmoid, but not to pull too much on it. Eight or ten sutures are now applied approximating the upper edge of the rectum to the surface of the sigmoid. If the patient be a woman, a dressed tube is passed through a counter-opening into the vagina, or if a man, is brought out below the tip of the coccyx and the abdomen closed. Finally a large tube is placed in the anus.

The closed end of the sigmoid may open spontaneously, or may require opening with a knife or scissors through a speculum.

If the general condition of the patient permit, I prefer not to open it for four or five days, even though the patient may suffer some from symptoms of obstruction of the bowel. This procedure was followed by me first, a number of years ago as an emergency one in a case of complete intestinal obstruction and was so successful that I have employed it since as the method of choice. I think the essential thing for its success is the distention of the closed sigmoid with gas or fluid which keeps the peritoneal surface of the sigmoid in contact with the raw surface of the rectum long enough for firm adhesions to form—secretions or blood are not confined between the surfaces, but can escape into the rectum freely. In the same procedure—applied to cancer of the rectum proper, the protruding sigmoid generally sloughs to a considerable extent within and even above the sphincter, though its blood supply may seem good at the time. I have not seen this happen in the higher operation, for the sigmoid does not have to be freed so much that its blood supply need be jeopardized at all, or at any rate, not so much that it cannot stand the distention.

In those cases in which the obstruction is complete and of such long standing that the sigmoid is enormously distended,

the condition of the patient may be such that immediate colostomy is necessary. In this event, after the colostomy, there is time and opportunity for preparation of the bowel above and below the obstruction, and either end-to-end suture or implantation may perhaps be safely done, but I have had no more trying, difficult, tedious and uncertain work to do than this within the abdomen. While I am a sincere advocate of two-stage operations in general, when the indications are clear, I am quite the contrary otherwise, and much prefer to take some chances and avoid two operations if possible. Particularly do I feel averse to a temporary colostomy, and rarely have done one without first opening the abdomen in the midline to see if it could not be avoided.

In case of disease or obstruction of the large bowel at the location under consideration, the procedure above given so far as my knowledge goes, is the only one that gives a reasonable chance of success without a preliminary colostomy. As a matter of fact, it is comparable to a two-stage colostomy into the rectum. The procedure in question can be done as rapidly as an ordinary lateral anastomosis in a more favorable situation and without much more danger of infection than the first step of a colostomy. Of 8 cases in which I have followed this procedure, 1 died from peritonitis, the result, I think, of the spontaneous opening of the sigmoid on the second day. In 2 cases, one a man and the other a woman, there was fecal discharge through the drainage tube, in one quite profuse, but in both cases the fistula healed spontaneously in a few weeks. The portion of the sigmoid projecting into the rectum contracts and in some cases subsequent dilatation is required. The fact that both sigmoid and rectum are dilated while adhesion is taking place may explain why no difficulty has been observed from stenosis at the line of union as is usual in resection of the rectum with end-to-end suture through Kraske's incision.

In 6 of the cases the operation was done for cancer. In 1 of these in which the sigmoid alone was involved in the growth, there was no recurrence after three years. Of 2 in which both

rectum and sigmoid were involved, in 1 there is no evidence of local recurrence after six months. The other was living and free from recurrence five years after operation. One patient died, after a year, of pneumonia. In this case both rectum and sigmoid were involved, but there was no evidence of either local or general recurrence three months before death when last seen. The other 2, in which both rectum and sigmoid were involved, died within a year of local and general carcinosis.

CASE I.—Operation at City and County Hospital. Records destroyed in fire of 1906. Patient was a woman with obstruction of the bowels with moderate distention, but without acute symptoms. A midline incision was made and the obstruction was found due to an annular carcinoma of the sigmoid just above the brim of the pelvis. In the manipulation the gut separated in the middle of the constriction without leakage from either end. A clamp was immediately applied to the sigmoid and its mesentery ligated sufficiently to permit of resection above the growth and closure of its end with a double row of sutures, the intention being to do a lateral anastomosis of the sigmoid with the anterior wall of the rectum. The portion of the growth remaining was then removed, the line of section through the rectum passing below the brim of the pelvis. While endeavoring to close the end of the rectum before making the anastomosis the patient's condition became bad and great difficulty was experienced in keeping the bowels out of the way. In desperation I abandoned the plan of anastomosis and rapidly removed the mucosa from the upper part of the rectum, slipped the sutured end of the sigmoid into it, removed the clamp and sutured the edge of the raw surface of the rectum to the sigmoid with catgut sutures. An opening in the vault of the vagina was then made and iodoform gauze drains inserted, passing to each side of the rectum below the suture line. She did not suffer from the continued intestinal obstruction, and after several days the closed end of the sigmoid gave way spontaneously, which was fortunate, as it was beyond the reach of my finger or vision with the specula we then had. There was no fecal discharge following

on removal of the drain. Nine months or so later she was without signs of recurrence, but was reported a few months later to have died of pneumonia.

CASE II.—Miss D., Lane Hospital, January, 1900. Operation for chronic obstruction of the bowels. Obstruction was found to be due to a small tumor of the sigmoid so close to the brim of the pelvis that in excising it an inch or more of the rectum had to be removed. Many mesenteric glands were enlarged and several were included in the mesosigmoid removed with the tumor. It was decided to try the same procedure described under Case I. The obstruction was not so great as to prevent the bowels being thoroughly cleaned out previous to operation. Previous to doing the resection the sphincter was stretched and the rectum washed out through a speculum and packed with gauze. The sutured end of the sigmoid was drawn into the denuded rectum by a stay suture which was fastened to the skin outside of the anus. The sigmoid opened spontaneously on the sixth day. There was no fecal discharge after removing the drain. The pathological report was typical adenocarcinoma, but the enlarged glands showed no metastases. The patient was in good health three years later when last seen.

CASE III.—Mrs. S., Lane Hospital, July, 1900. Admitted with symptoms of acute intestinal obstruction. There was a previous history of pelvic pain and intestinal cramps. Pelvic examination disclosed tender masses in both ovarian regions. Midline incision. There was free peritoneal fluid and the pelvis was full of adhesions. The right tube was greatly enlarged and thickened and both ovaries enlarged. Adhesions were dense and much sharp dissection required. The obstruction was found due to angulation and adhesion of the small bowel. In removing the right tube and ovary the rectum was torn open at the brim of the pelvis and suture of the opening was not possible on account of rigidity and edema of the rectal wall. It was finally decided to repeat the operation described in Case I. Numerous high enemata had been given before operation in the hope of relieving the obstruction, so both rectum and sigmoid were empty. Sec-

tion of the sigmoid was made at a point where its walls were normal and section of the rectum was some distance below the brim of the pelvis. Rectal mucosa was removed and the closed end of the sigmoid was drawn into the rectum by a suture passed through the stump of its mesentery and fastened to the skin outside of the anus. On the fourth day the bowel opened spontaneously, and on removal of the drain from the vagina the following day feces came through the opening. A tubular drain was inserted in the drainage opening and sutured to the vagina. The sphincter was stretched and a large tube left in the anus. The discharge from the vagina continued for several weeks and then ceased, and the drain was removed. The patient was discharged and disappeared from observation. Microscopic examination of the removed tube showed many tubercles in its mucosa, but there were none noticed in the peritoneum at operation.

Case IV.—Mr. A. I. O., Lane Hospital, May, 1903. Carcinoma of the rectum just palpable by tip of the finger when the patient strained. Abdominal incision. Large tumor at brim of the pelvis, involving both rectum and sigmoid. Resection of tumor and implantation of closed sigmoid into the denuded rectum. The protruding end of the sigmoid could be felt in the rectum and was opened with a scalpel on the fourth day, on account of general abdominal distention and vomiting. No fecal discharge on removal of drain. Patient left the hospital on the twenty-seventh day. Pathological report was alveolar carcinoma. Patient died the following year from both local and general recurrence.

Case V.—Mrs. C. H., Lane Hospital, September, 1903. Patient came for relief of hemorrhoids. Examination showed blood and mucus coming from high up in the rectum, but no growth could be felt or seen by means of the speculum. There were no symptoms of obstruction of the bowels. Abdominal incision disclosed a hard mass in the wall of the rectum at the junction of the sigmoid. Resection of involved rectum and sigmoid and invagination of the sutured end of the sigmoid as described in

Case I. Removal of vaginal drain followed by fecal discharge lasting for four weeks. Patient died a year later from general carcinosis.

Case VI.—City and County Hospital. Records lost in the fire of 1906. Patient was a heavy man, operated on for what was supposed to be appendicitis. The greatest tenderness was near the midline, and under the anesthetic an ill-defined mass could be made out by rectal examination. A midline incision was made and the mass found to have no connection with the appendix, but due to a small abscess between the sigmoid and rectum near the brim of the pelvis. There was an opening into the sigmoid communicating with the abscess, and the case was regarded as one of cancer with spontaneous perforation. Involved sigmoid and rectum were removed and the closed end of the sigmoid pulled into the denuded rectum as previously described. The rectal wall was edematous and rigid at the point of section, and bleeding was serious. On the second day after operation feces came through the rectum and the man died of peritonitis from feces escaping into the pelvis. The mass proved to be inflammatory, and I have since concluded that it was a case of false diverticulitis, a condition of which I was ignorant at the time.

Case VII.—Mr. H. A. S., Lane Hospital, October, 1909. Growth in the rectum beyond reach of finger but visible with proctoscope. Abdominal incision. Tumor of upper part of the rectum was found involving the sigmoid. Resection included upper part of the rectum and the lower part of the sigmoid. Denudation of the rectum and invagination of the closed end of sigmoid was done. Drainage inserted through counter-opening at tip of the coccyx. Spontaneous opening and discharge of feces on the fifth day. No fecal discharge followed removal of drain. Pathologist's report was adenocarcinoma. Patient seen last in 1914 and presented no evidence of recurrence.

Case VIII.—Mrs. F., Dameron Hospital, Stockton, Cal., November, 1916. High rectal carcinoma, lower border just palpable with tip of finger, when patient was under anesthetic.

Abdominal incision. Resection of three inches of upper part of the rectum and the lower part of the sigmoid. Denudation of the rectum and invagination of closed sigmoid. Sigmoid opened with scalpel on fifth day on account of vomiting. Fecal discharge followed removal of vaginal drain, but ceased in about two weeks. Reported to be without signs of local recurrence after six months. Pathological report was adenocarcinoma.

DISCUSSION

Dr. Howard Lilienthal, New York City:

Having known of the method which Dr. Stillman has described, it suggested to me in a recent case another method which is even simpler, and in this particular case the result was so brilliant and satisfactory that I feel it my duty to report it. The patient was a man of fifty-five years who had a partially constricting angular scirrhus exactly at the rectosigmoid junction. I worked out the plan of operation in advance and carried it out to the letter. The steps were as follows: Incision in the left paramedian line, complete mobilization of the lower part of the sigmoid and upper part of rectum. Stretching the sphincter by an assistant, puncturing with a fine scalpel the wall of the sigmoid within the abdomen and inserting a large-headed probe through this opening and passing it down through the anus where it was taken in charge by an assistant. A piece of thin tape was now pushed through the eye of the probe, still in the abdomen, and the other end of the tape was tied tightly around the sigmoid within the abdomen. Then while the wound was well retracted so that I could see what was going on the assistant withdrew the probe from the anus until the tape appeared. He then made traction on the tape so that we had a complete invagination with exposure of the entire involved intestine, inside out and beyond the anus where it was widely removed with the greatest ease, suturing the intussusceptum and the intussuscipiens together as the resection proceeded. This line of suture was reinforced with another line. A large drainage tube was put into the lumen of the intestine from below and the intussusception now containing the tube was easily pushed back, the tube being long enough to extend beyond the anus. The specimen showed that the tumor had been completely removed with at least two inches on each side of its limits. There was no leakage and the patient made a complete recovery after an easy convalescence. Drainage, of course, was instituted through the abdomen, but as before stated, there was not the slightest leak and not even a fecal odor to the discharges through the drainage opening.

[Note.—At the time of sending these notes to press, three months after the operation, the examining finger in the rectum cannot detect the slightest irregularity.]

Dr. John J. Buchanan, Pittsburgh, Pa:

Dr. Stillman's operation, as I understand it, is invagination of the serous surface of the intestine above into the segment of intestine below which he has made raw inside. This is a modification of an operation of a most alluring kind which attracted a great deal of attention ten or twelve years ago—an operation for the excision of the

rectum, drawing the sigmoid or even the descending colon through the pelvis and attaching it at the level of the preserved sphincter; in other words, of removing the diseased part of the rectum or sigmoid and saving the sphincter for its proper use. Ten years ago I published a paper on this subject and was very enthusiastic concerning the result in cases, especially of tight strictures, of a non-malignant kind, these patients having retained their sphincter power and an artificial anus being saved. A number of cases of malignant stricture also were brilliant successes, as Dr. Lilienthal has mentioned, but finally after a more extended experience I found that there was one fatal defect, that is, that when the bowel was drawn through we could not tell whether that bowel had retained its vitality. It might seem to have a good blood supply, and Dr. Lusk worked that out in a most elaborate way, but no one can draw the sigmoid colon outside and cut the diseased part off and be sure he will have a living bowel above. It may slough because we have cut off its essential blood supply, or because it is put on such a stretch. In one case of carcinoma high up in the rectum I delivered a piece of bowel in which I felt I had sufficient blood supply, but this failed and later required an artificial anus. The patient suffered so much that the game was not worth the candle, and in this case it would have been better to make an artificial anus to start with. These operations for removing the rectum and sigmoid and saving the sphincter in the long run will be disappointing, although brilliant when they do succeed.

Dr. Stanley Stillman, San Francisco (in closing):

So far as Dr. Lilienthal's procedure is concerned, the difficulty I have experienced in freeing the sigmoid sufficiently to bring it out of the anus without subjecting it to the hazard Dr. Buchanan refers to convinces me that his procedure can only be employed in exceptional cases. I spoke of having employed a similar method in cases of cancer of the rectum proper as Dr. Buchanan has, and in these cases I have had the satisfaction of having two or three brilliant successes, as I stated in the paper. These have encouraged me to keep on trying, and while the protruding end of the bowel has sloughed higher than I wished in some cases, there has usually been a useful and controllable anus.

My paper is not on cancer of the rectum, as some of the remarks would seem to indicate, but on resection at the rectosigmoid junction, and the discussion should have been limited to that subject. Colostomy on the right side has been most unsatisfactory in the few cases I have seen. The contents of the cecum are fluid and irritating to the skin and in a recent case in which the opening was made for a non-malignant obstruction at the hepatic flexure the patient failed to gain in weight or strength, although eating well, until the opening was closed.

A SIMPLE METHOD OF RESECTING THE TRANSVERSE COLON WITH PRESERVATION OF THE OMENTUM

By JOHN E. SUMMERS, M.D.
OMAHA, NEBRASKA

It is not the purpose of this paper to presume to offer anything original but rather to emphasize the value of a procedure apparently too little appreciated by surgeons, if one is to judge from observations of their clinical work and from journal and textbook publications.

Resection of the transverse colon when done for other than malignant disease, as, for example, redundancy and ptosis, sacrifices the omentum, thus leaving uncovered peritoneal surfaces, difficult to protect without disturbing relations of viscera which had better be let alone. I am familiar with the work of Lardennois and Okinczyc and its still further elaboration by Pauchet, in which they make use of the clinical fact that the omentum can be easily and safely separated from the transverse colon and its mesentery up to the lower border of the stomach, widely opening the lesser cavity of the peritoneum if desired. Thus all of the posterior wall of the stomach, that also of the first part and of the upper portion of the second part of the duodenum is exposed: the pancreas is also exposed. Prof. Pauchet published a most interesting illustrated article in *Bull. et mém. de la Soc. de Chir. de Paris*, May 10, 1916, a most excellent and favorable criticism and reproduction of which was published last fall by Dr. Sherwood-Dunn, of Paris, in *Am. Jour. Surg.* The technic admits of ready exposure and surgical intervention upon all of the parts

exposed when they may be the seat of trauma or disease. The separation of the omentum from the transverse colon and the transverse mesocolon depends upon the anatomical arrangement and relationship of the peritoneum. A bloodless, loose peritoneal ligament is formed along the upper border of the transverse colon by the juncture of the layer of peritoneum covering the stomach anteriorly and the omentum both anteriorly and posteriorly with that enveloping the transverse colon; the latter goes posteriorly to cover the transverse mesocolon—anteriorly forming the posterior layer of the lesser peritoneal cavity, spreading out below into the posterior layer of the greater peritoneal sac. The technic of resection of the transverse colon advocated is carried out after an *x*-ray study of the relative positions of the hollow viscera. A liberal incision having been made, the bowel is delivered and made taut by assistants. The operator lifts up the omentum with one hand sufficiently to recognize the line of juncture of its under surface with the upper surface of the colon. With a sharp-pointed knife (a straight bistoury preferably) the peritoneum is nicked along this ligamentous line to the desired extent of resection. With a gauze sponge the omentum is freed upward from the transverse mesocolon to the lower border of the stomach, exposing but not injuring the mesenteric bloodvessels. The resection of the colon is then done in the usual manner, being facilitated by an accurate view from above of each bloodvessel in the mesentery. After completion of the anastomosis, end to end or lateral, the omentum is made to cover the line or lines of suture of the anastomosis in such a way as indicated by the particular case, and otherwise to resume, so far as practicable, its protective position. Lardennois makes a colectomy by first separating the omentum as I have described for resection of the transverse colon, then going to the left divides the avascular suspensory peritoneal band (the suspensory splenic ligament), dividing then the outer peritoneum, as is usually done in mobilization—practically a like manipulation is done on the right side—the bowel being mobilized is resected in the usual way. Binnie's *Operative Surgery* is the only book

in English in which there may be found a description of this excellent and safe operation of colectomy. In a number of instances during the past year I have employed a technic for the correction of prolapse of the transverse colon based upon the Lardennois-Okinczyc-Pauchet studies in clinical anatomy. None of the operations commonly advocated for this purpose have been satisfactory to me. What I am now doing seems to promise well: there have been no ill after-affects. It consists in opening the lesser cavity of the peritoneum as described, suturing the transverse colon to the posterior wall of the stomach along the line of its greatest curvature, thus practically placing the transverse colon in the lesser peritoneal cavity, then dropping the omentum forward. In several instances in which the hepatic flexure was not properly fixed by this technic I have brought up a piece of omentum to the right of its detachment from the colon, and after ascertaining by upper and outward traction the proper position of the flexure, have sutured this omentum to the parietal peritoneum. This lifting of the hepatic flexure might be accomplished from behind by a retroperitoneal incision, fastening the so-called nephrocolic ligament to the lumbar fascia. When the position of the stomach has appeared to require, I have in addition done a gastropexy.

Of course the few months' trial of this technic can to date only be suggestive.

THE SURGERY OF THE LARGE INTESTINE

By ARTHUR DEAN BEVAN, M.D.
CHICAGO

THE last ten to fifteen years have shown much progress in our means of diagnosis and in the surgical therapy of lesions of the large intestine. It is my intention to review this subject largely from the impressions obtained from the experience in my own clinic. The embryology of the large intestine is now well understood. Its development from the midgut and the hindgut, its rotation, the normal development of the midgut and hindgut, and the abnormalities of development due to failure of normal rotation, and failure of normal union with the resulting various types of imperforate anus are well known to the clinical surgeon and demand no detailed description here. The anatomy and especially those facts that are of importance in diagnosis and in surgical technic have been well worked out and the *x*-ray examinations made with bismuth and barium injections have given us a new and greatly different conception of the colon from the standpoint of location and arrangement of its different segments in the abdomen, and careful studies of this kind have shown the wide range of variations within normal limits of the length, the position and arrangement of the different portions of the large bowel. The cecum, the ascending, the transverse and the descending colon, the sigmoid and the rectum all show in the *x*-ray wide variations from our old preconceived pictures of the normal anatomy of these structures. In the early history of these *x*-ray examinations many unnecessary and unwarranted operations were done for the purpose of correcting such conditions as a low-

lying transverse colon, or to diminish a too voluminous cecum in cases which we now know or should know are well within the normal limits, and were in fact normal to the individual operated on. Some of these operations done upon *x*-ray evidence improperly interpreted have been peculiarly pathetic, notably operations done to correct incompetency of the ileocecal valve, as shown by a filling of the last six or eight inches of the ileum with the barium solution which had been injected into the colon.

In one clinic, or rather sanatorium, in this country in one year a hundred and twenty-odd laparotomies were done to correct this condition of incompetency of the ileocecal valve, as shown by *x*-ray examination. It is now known, or should be known, that this filling of the ileum from the colon is a common occurrence entirely within the range of the normal. X-ray examinations with barium have added enormously to our means of diagnosis in lesions of the large intestine when the evidence obtained is properly interpreted. It may, however, do a great deal of harm in the hands of the ignorant and the illogical. Too great stress therefore cannot be placed on the proper interpretation of *x*-ray findings in colon cases.

The physiology of the colon should be most carefully studied by the surgeon who operates on this segment of the intestinal tract. Too often the colon has been removed or sidetracked without any regard to the resulting loss of this portion of the alimentary tract and apparently with the conception that it has little or no function of importance. As a matter of fact the colon performs a most important function in alimentation.

Function of the Large Intestine. The function of the large intestine may be deduced from a consideration of the following points:

Secretion and Absorption.[1] "Observation upon the secretions of the large intestine have been made upon human beings in cases of anus preternaturalis in which the lower portion of the intestine was practically isolated, and also upon lower animals, in which an artificial anus was established at the end of the small

[1] Howell: Text-book of Physiology, 1915, p. 806.

intestine. These observations all indicate that the secretion of the large intestine, while it contains much mucus and shows an alkaline reaction, is not characterized by the presence of distinctive enzymes. When the contents of the small intestine pass the valve they still contain a certain amount of unabsorbed food material. . . . These contents remain a long time in the large intestine, and since they contain the digestive enzymes received in the duodenum, the digestive and absorptive processes no doubt continue as in the small intestine. This general fact is well illustrated in experiments made upon dogs most of whose small intestine (70 to 83 per cent.) had been removed.[1] These animals could digest and absorb well and formed normal feces, provided care was taken with the diet. An excess of fat or indigestible material caused diarrhea and serious loss of food material in the feces. . . . In the large intestine the absorption of water is not compensated by a secretion; the material (intestinal content) loses water rapidly while in the ascending colon and before it reaches the descending colon it has acquired the consistency of feces."

In addition to the water and digested food many of the products of bacterial putrefaction are absorbed from the colon, as may be demonstrated by the recovery of such substance from the urine. Undigested protein, starches and fats are not absorbed, neither are they digested unless they come in contact with enzymes originating above the ileocecal valve.

It is assumed by some[2] that the colon is the site for the excretion of certain unknown toxic materials, and hence is of importance from that stand-point, but the evidence for such a view is exceedingly scanty.

Movements. The movements of the colon partake of three general types: There is first a wave-like, churning, segmenting motion in which even the haustra coli may join; second, a so-called mass motion whereby masses of intestinal content may be moved suddenly from one part of the colon to another; third, a

[1] Erlanger and Hewlett: Am. Jour. Physiol., 1902, vi.

[2] Drefer and Lynch: Am. Jour. Med. Sc., 1914, cxlviii, 828.

definite zone of contraction at about the middle of the transverse colon from which peristaltic waves proceed distalward and antiperistaltic waves proximalward. Occasionally peristalsis may involve the entire colon, but as a rule anastalsis predominates in the cecum and ascending colon. These movements were first observed in animals, but during the past two or three years have been seen repeatedly in man. The antiperistalsis forces the feces into the blind cecum; regurgitation into the ileum is prevented by (1) the ileocecal valve and (2) the ileocecal sphincter. These structures are frequently incompetent as regards enemas, but usually competent insofar as material which has passed through the stomach is concerned (Cannon, Potter, Case), although Case has seen over 50 cases in which material after passing from the small intestine into the colon has been regurgitated into the ileum from the cecum.

According to Hertz[1] food requires about two hours to pass from the ileocecal valve to the hepatic flexure and about four and a half hours to reach the splenic flexure. As the colon becomes filled some of the material penetrates into the descending part where the normal peristalsis carries it very slowly toward the rectum, or it may be carried into the rectum or descending colon *en masse* by one of the mass movements.

Fecal matter is normally absent from the rectum except just before defecation It seems probable that a distinct desire to defecate is felt only when the feces have actually entered the rectum and produced some distention.

Howell concludes "that the whole act of defecation is at bottom an involuntary reflex. The physiological center for the movement probably lies in the lumbar cord, and it has sensory and motor connections with the rectum and the muscles of defecation . . . the inhibitory fibers to the internal sphincter pass by way of the hypogastric nerve, the motor fibers through the nervous erigens, and both of these nerves contain efferent fibers which may reflexly excite inhibition or contraction. But this

[1] Guy's Hospital Reports, 1907, lxi, 389; and Jour. Physiol., 1913–14, xlvii, 57.

center is probably provided also with intraspinal connections with the centers of the cerebrum, through which the act may be controlled by voluntary impulses and by various psychical states, the effect of emotions upon defecation being a matter of common knowledge. In infants the essentially involuntary character of the act is well known."

Colonic Contents. The material passed through the ileocecal valve is usually quite watery and contains waste materials from the small intestine together with a small amount of undigested or unabsorbed food and ferments. The water and soluble food materials together with some extranous matter-products of bacterial fermentation, etc., is absorbed largely in the cecum and ascending colon and the feces reach the sigmoid at about the consistency at which they are extruded from the rectum. As has already been pointed out, residual digestion goes on in the colon by means of enzymes carried down from above. As Howell points out, putrefaction is a constant and normal occurrence in the large intestine. Is this process in any way necessary to normal digestion and nutrition? Nuttell and Thierfelder[1] kept young guinea-pigs sterile from birth, feeding them with sterile food. The animals lived and increased in weight. Levin[2] finds that animals in arctic regions in many cases have no bacteria in the intestines. From these facts it is assumed that bacteria are unnecessary. According to the extreme views of Metchnikoff and his followers the intestinal bacterial flora is responsible for the decrepitudes of old age and most of the ills that flesh is heir to. Howell deems it wise to take the conservative view that while the presence of the bacteria confers no positive benefit, the organism has adapted itself under usual conditions to neutralize their injurious action.

Conclusion. The colon appears to be specialized as the salvage segment of the gastro-intestinal tract. Here the remnants of digestion are completed; the water no longer needed to assist

[1] Ztschr. f. physiol. Chemie, 1895, xxi, 109; 1896, xxii, 22; 1897, xxiii, 231.

[2] Skandinevischer Archiv f. Physiologie, 1904, xvi, 243.

enzyme activity is absorbed together with the remaining products of digestion, and the intestinal contents are reduced to the lowest terms of usefulness to the body preparatory to their extrusion.

To be sure, an individual can live without a colon, but so can he also without his stomach, but the loss of either is a most serious handicap to his health and happiness and it should never be incurred except in the face of absolute necessity.

In discussing the surgery of the large intestine the subject readily divides itself into two groups of cases: one where the operation is done for some organic lesion and the other for some functional or supposed functional condition such as constipation, intestinal stasis or the imagined results of intestinal stasis, such as epilepsy, as advocated by Reed, or tuberculosis, exophthalmic goiter or cystic disease of the breast, as advocated by Lane.

The most startling chapter in surgery of the large intestine has been furnished by the work of Sir Arbuthnot Lane and his followers in their conception of intestinal stasis, their interpretation of the supposed cause and results of such a condition and their suggestions of its cure by surgical operations. When I heard Lane read his paper on this subject before the American Surgical Association I could not accept his theories nor his conclusions that these cases should be handled by surgical means, and in the discussion I emphasized the importance of demanding the definite existence of lesions producing obstructive symptoms or capable of producing obstructive symptoms before we submit patients to such surgical operations as ileosigmoidostomy or resection of the colon. As I have watched the development of this work I have been more and more convinced of the fallacy of this work. Possibly the best review of this subject has been presented by Dr. J. George Adami, professor of pathology at McGill University, in an article in the *British Medical Journal*.

Dr. Adami discusses the subject of intestinal stasis and the facts presented by Sir Arbuthnot Lane from the stand-point of modern pathology and physiology. Lane's conception is that chronic intestinal stasis means that the passage of the contents

of the intestinal canal is delayed with the resulting production of toxic material which is absorbed into the circulation and which produces degenerative changes of every single tissue of the body, and lowers its resisting power to invasion by deleterious organisms. He ascribes these disturbances primarily to delay of fecal matter in the large bowel. This loading of the large bowel produces downward displacement and dragging upon other organs in the abdominal cavity, and produces kinks and partial obstructions of the small intestine, delaying the passage of the contents of the small intestine. He believes that the auto-intoxication of this chronic intestinal stasis produces a great many symptoms which he describes under 17 heads:

1. Loss of weight.
2. Wasting of muscles.
3. Alteration in the skin.
4. Subnormal temperature.
5. Mental conditions of apathy, stupidity, etc.
6. Rheumatic pains.
7. Atrophy of the thyroid gland.
8. Changes in blood-pressure.
9. Degenerative changes in the mammary gland.
10. Prolapse of the abdominal organs, mobility of the kidneys, prolapse of the uterus, etc.
11. Breathlessness on exertion.
12. Degeneration of heart muscle.
13. Bright's disease.
14. Loss of hair.
15. Lesions of the pancreas, chronic inflammation, cancer, pancreatic diabetes.
16. Infection of the biliary tract, gall-stones, cancer, etc.
17. Degenerative diseases of the eye.

As indirect results Lane presents as a few of the obvious typical indirect results of intestinal stasis:

1. Pyorrhea alveolaris.
2. Tuberculous infections.
3. Rheumatoid arthritis.

4. Infections of the genito-urinary tract, pyelitis, salpingitis, etc.

5. Thyroid disorders such as exophthalmic goiter, adenomatous tumors.

6. Still's disease.

7. Pustular infections of the skin.

8. Infections of the large intestine such as ulcerative colitis.

9. Ulcerative endocarditis.

In announcing these conclusions Lane presented 17 patients with their reports as evidence that the above various conditions can be cured by the operations of ileosigmoidostomy, or the removal of the colon, or by removing the obstructive bands. Adami, in presenting these facts, says that "instinctively we are thrown into an attitude of doubt, instinctively we feel that Lane may have fallen a victim to that most dangerous, if it be not the last infirmity of noble minds—obsession." And he asks the question "Is Lane justified in his teaching or is he a victim of obsession?"

He then describes very fully the subject of auto-intoxication and the etiology of intestinal stasis and points out that the colon has a very definite and important function and says that although a man can manage to exist without a stomach there is no reason to recommend gastrectomy for chronic dyspepsia, however excellent this operation might be in cancerous conditions. He says clearly there is indication for radical operations on the colon for malignant growths and severe ulcerating processes, but not for such conditions as constipation or so-called intestinal stasis. He cannot agree with Lane's idea that the colon is merely a common sink and thinks the danger of this false doctrine is that encouraged by Lane's advocacy, immature surgeons of two continents, regarding the colon as of no account, would inaugurate an era of short circuiting or colectomy for all sorts and conditions of diseases on the smallest possible pretext. He believes that it is too grave a responsibility to assume, *i. e.*, starting an epidemic of operative surgery purely on an empirical basis.

Adami's article is an exhaustive discussion of this whole subject from the stand-point of modern physiology and pathology and is a severe arraignment of Lane's theory of intestinal stasis and the surgical operations which he has suggested for the relief of these conditions, and those who are interested in this subject from a practical stand-point should read Adami's article before undertaking any of this work. As Adami fears, the doctrines advocated by Lane have been adopted by immature surgeons, and this era of short circuiting and colectomy has in fact been inaugurated, and these operations have been done on the smallest possible pretext. So much of this work has been done that we are now in a position to analyze the results and to arrive at definite conclusions as to their value. These results have been so shocking both from the stand-point of mortality and resulting distress from interference of normal function that those who analyze them in a non-partisan and judicial way must be forced to the conclusion that the time has arrived when the surgical profession must take the stand that these operations are absolutely unwarranted and unnecessary, and they must from this time on receive the stamp of disapproval by modern scientific surgeons.

As a good example of this work let me report briefly a case which we have recently had under observation. A trained nurse who was a marked neurotic had suffered for years from rather severe constipation. She was operated upon by a very capable surgeon and an ileosigmoidostomy performed. This was followed by very distressing symptoms. The entire colon proximal to the anastomosis would become filled with fecal matter in its effort to extrude these fecal masses. There resulted great abdominal distress and pain and marked visible peristalsis. Barium meal injections of the colon with barium showed that the material remained for weeks in the colon, filled up the colon from the cecum to the point of anastomosis. The picture was a most distressing one. At the request of my colleague, Dr. Sippy, I operated on her and restored the intestinal tract to its normal condition by separating the ileum from the sigmoid and closing

the opening in each viscus. The woman was in rather bad condition at the time of the operation with a colon full of hardened fecal masses, but she went on to an excellent operative recovery, and with enemas and mild cathartics within a few weeks the colon had returned to normal, and under proper feeding and medical management she was not only relieved of her abdominal distress but also of her constipation, proving very conclusively that not only was the former operation dangerous and harmful, but also unnecessary, and that the constipation in her case could be controlled by proper medical management, a line of treatment which should have been adopted from the start. We have had a number of similar cases confirming these facts. In our own clinic operations for organic lesions have been done largely for neoplasms, especially carcinoma, for tuberculosis, for benign stricture, for obstructions due to inflammatory processes and for diverticulitis.

In the limited time at my disposal it is impossible for me to discuss these in detail. There are, however, certain basic principles which have been demonstrated to us as a result of our work which I am desirous of presenting to you, and I think that I can bring these out best by showing their importance in relation to the diagnosis and surgical treatment of carcinoma of the large intestine. First, a few words in regard to diagnosis. We have divided the evidence on which a clinical diagnosis is made into the following four points:

1. The history.
2. The physical examination.
3. The laboratory findings, blood, ameba, etc.
4. The *x*-ray findings.

We have attempted to make each one of these cases a piece of scientific clinical research and then have attempted to analyze a large group, 100 cases or more, and determine the value of these various pieces of evidence in arriving at the correct diagnosis. These pieces of clinical research have been conducted by our surgical department in association with the internists on the hospital staff and the men in charge of our *x*-ray laboratory.

The internists have also controlled the laboratory side of the investigation. In reviewing a large series of these cases we have been impressed with the fact that the most important evidence is a careful and full history properly interpreted. I think one might safely say that if we could express it numerically, of a hundred points, this would form fifty or more, at least one-half of the total value of the evidence obtained. One could not apply this to an individual case but to a large group of cases. The balance of the hundred points would be made up of the other three groups of evidence, the physical examination, the laboratory findings and the *x*-ray findings and would differ very much in individual cases. In some such as amebic dysentery the laboratory findings would be determining. In others the physical examination and in still others the *x*-ray findings furnish the main piece of evidence upon which the clinical diagnosis rests. In handling these colon cases as pieces of clinical research jointly by the internist, the *x*-rays and the surgeon, we have felt that it has been very instructive for all of the medical men interested and that we have been able to arrive at more accurate clinical diagnoses, and frequently earlier diagnoses have made it possible to give the patients the benefit of early radical operations and the greatest possible prospect of permanent relief. This scheme has worked so well in our hospital that I want to urge its general adoption.

The question of the best technic in radical removal of a section of the colon can now be answered with a good deal of certainty. There are here four great principles which must be observed:

1. Wide exposure, usually an extensive midline incision.

2. Mobilization of the colon by dividing to the necessary extent the outer non-vascular layer of the mesocolon and bringing the desired portion of the colon freely out of the abdomen as we might a loop of normal ileum.

3. Resection of the involved colon, closure of both ends by purse-string or layer suture, and side-to-side anastomosis as in a gastro-enterostomy.

4. Radical operation should not be done in the presence of existing obstruction but should be preceded by a colostomy to relieve the obstruction. In some cases where the obstructive symptoms are of minor degree this radical operation may be done but should then be made safer by providing a safety-valve for the relief of gas-pressure by introducing a small rubber tube—we use a No. 12 English catheter proximal to the resection either into the colon or ileum. This is made gas-tight by invaginating it with two or three purse-string sutures into the bowel. I prefer this last method to the Mikulicz plan which necessitates two or more operations to complete the cure. As a rule, if a half-inch or more of the bowel is invaginated with the catheter the small opening closes spontaneously after it is removed. The four principles I have outlined have given most gratifying results in increasing the percentage of operable cases, simplifying the operations, reducing the mortality and increasing the number of cases of permanent cures and long palliation. This operative plan should be adopted for all parts of the large intestine to which it can be applied. Unfortunately it cannot be employed in cases of carcinoma near the rectosigmoid junction, or carcinomas of the rectum.

In these cases we have run the gamut up and down and back again. We have done many Kraskes with a resulting sacral anus. We have done tube resection, invaginating the sigmoid into the rectum and the combined inguinal anus and removal of the carcinoma from below both in one and two stages. We believe that we have now come to a rather fixed position in regard to these cases, at least one that is giving us more satisfaction than the plans we have heretofore adopted. I shall describe this briefly:

We divide the cases of carcinoma from the rectosigmoid to the anus into two groups:

1. Cases of small local carcinomas at the anus or within an inch or two of the sphincter without glandular involvement.

2. Extensive carcinoma from the sphincter to the rectosigmoid junction.

In the first group of small early carcinomas near the sphincter we have developed the plan of splitting open the rectum posteriorly (the patient lying face down on a table arranged like a double inclined plane with the sacrum at the high point). If necessary the coccyx is removed and the carcinomas is fully and widely exposed and brought completely into view and under control. The finger can explore the space between the rectum and sacrum and if no extensive glandular involvement is found the carcinoma is cut out widely with a Paquelin cautery. The incision in the posterior rectal wall is closed with suture and the wound, made by removing the carcinoma with the cautery, is packed with iodoform gauze and left to heal by granulation. It is surprising how much control these patients secure where not more than one-half of the caliber of the gut and the sphincter are removed. We have a number of the cases alive and well two and three years after operation, and I am convinced that this plan has a distinct place in small carcinomas of the lower rectum. The extensive carcinomas of the rectosigmoid and rectum are best handled today by radical removal, and a left inguinal anus. If possible this operation should be done at one sitting but provision must be made for an immediate safety-valve to relieve gas-pressure by sewing into the end of the sigmoid brought out at the inguinal anus a No. 12 English catheter with two purse-string sutures to ensure against leakage into the wound. This is cut out with a cautery on about the third day, but in the meantime the patient is entirely free from distention and gas pains. If there is any tendency to block up the catheter with fecal matter it can be cleaned out by injection, every few hours, of a few drams of water through it. In carcinoma of the colon where a radical operation is out of the question and obstruction exists, one of two plans have been adopted: an anastomosis or an artificial anus, and where advisable, these have been done under local anesthesia.

Time will not permit me to go fully into the subject of the surgery of the colon for other conditions besides that of carcinoma. I should like, however, briefly to summarize some of our conclusions from the colon work we have done for other lesions.

In tuberculosis of the large intestine we have been impressed from our results with the fact that wherever possible a resection rather than an anastomosis should be made, following the same technic as in resecting for carcinoma. Where the condition of the patient warranted and we have been able to do this, our results have been much more satisfactory both from the stand-point of permanent cure and of complete relief. We have therefore limited anastomosis operations in these cases largely to cases where, because of the condition of the patient, a radical operation was out of the question. To be sure, some of these anastomosis operations have been followed by satisfactory results, but this has been the exception. Closely associated with carcinoma of the large intestine, especially of the sigmoid, is the interesting condition of diverticulitis with the formation of tumor-like thickenings of the bowel simulating very closely carcinoma and difficult to distinguish carcinoma from it at the time of operation, and even sometimes confusing until after histological examinations have been made. Wherever possible these should be as radically resected as for cases of carcinoma. I have been compelled several times, where the mass involved the rectosigmoid junction and a resection operation was difficult, to make a permanent artificial anus in the left inguinal region.

DISCUSSION

Dr. Arpad G. Gerster, New York City:

I wish to state that in every respect, not excepting one word of what was said just now to you, I do endorse the attitude taken by Dr. Bevan. Ever since the fantastic theories of Lane have been enthusiastically adopted by a certain class of surgeons, I have felt that there was no scientific justification for this therapeutic attitude, that it was not based on pathological knowledge. The proofs to be drawn from the evidence of the histories published by Lane and his adherents are entirely inconclusive. Too many of these histories have been written in a slipshod and superficial way to permit us to accept them as evidence. Their predominant contents are extensive statements of subjective symptoms, recalling the literature of early homeopathy. Thus the proofs of the curative value of short circuiting are also made to rest on subjective allegations rather than on facts. When anyone heard from colleagues who visited the shrine that undertook to ask disagreeable questions, they were promptly short circuited. Such a body as the American Surgical Association ought to withhold its approval from procedures which invite deserved criticism due to this type of unscientific surgery.

Dr. Stanley Stillman, San Francisco:

I should also like to express my appreciation for what Dr. Bevan has said because I believe very heartily that not only in this but in everything else he says, he pretty nearly always strikes the nail on the head. I have had a good deal of pressure brought to bear on me by medical men to do some of these colon operations, but so far I have withstood the pressure. I think the two greatest pests I have had in the way of patients are two men on whom a complete removal of the colon had been done, one operated on this side of the continent, and one on the other, and they would give almost anything they possess to get their colons back again, and want me to devise some way of doing it. I believe Dr. Bevan, in speaking of tubular operations at the rectosigmoid juncture, extends the juncture beyond where I intended it to go this morning or where nature places it. I did not expect to be understood as including in my paper cancer or other disease of the rectum proper, extending all the way down the hollow of the sacrum clear to the anus, or cases in which there was any possibility of attacking the condition from below. The general proposition I agree with fully, that tubular operations as usually done are failures.

Dr. Charles L. Gibson, New York City:

I would like to say a word in favor of the Mikulicz operation which I understand Dr. Bevan rather puts in the second rank compared with the ideal operation of lateral anastomosis. Of course, to do a good Mikulicz operation one must have a slack intestine just as for the ideal operation of lateral anastomosis. But even under the best conditions of lateral anastomosis one is taking a chance. I maintain in the Mikulicz operation one has no element of gamble at all. You know just exactly what you are going to get and where you stand at every step. It is an unpleasant operation for the patient, it means three or four operative steps, a prolonged convalescence, an artificial anus for a long time, but you can practically guarantee your patient a perfect continuity and restoration of the intestinal canal and in no way jeopardize it. It should not be undertaken unless the ideal conditions can be carried out. I would suggest also the Mikulicz operation when a preliminary colostomy is used or recommended. In the majority of these cases of carcinoma of the large intestine there is intestinal obstruction, and this obstruction is an obstruction of the large not the small intestine; these are two entirely different propositions. In the large intestine the patients suffer little or no shock and do not suffer from dehydration as an obstruction of the small intestine. The vomiting is late and can be controlled. The type of obstruction is different, it is obturation, not strangulation. These people with a little judicious handling can be taken care of for several days. There is usually no haste for making an artificial anus. The Mikulicz operation can be done, the bowel mobilized, the loop of intestine brought out and left out with the two loops, afferent and efferent stitched at the proper levels where they are to be cut off. The abdomen can be closed except where the loop protrudes. By giving morphin we can refrain from opening the bowel for several days, thus we overcome the possibility of secondary contamination. I offer that as a logical, safe and certain substitute for the lateral anastomosis. I have done that operation when I have had to deal with a little carcinoma with a great big loop of intestine where lateral anastomosis might have been ideal. I want to thank Dr. Bevan for his paper. I have never been tempted to do one of these operations. I would like to add one instance: I had under my care a young gentleman whose appendectomy wound I closed. He had been treated for epilepsy which cleared up by the treatment of an ear condition of which the surgeon had no conception whatever.

Dr. James E. Moore, Minneapolis:

I have of late been classed among the conservatives, although I have broken the rule a good many times. In listening to this iconoclastic paper by Dr. Bevan I have been recalling very forcibly my experiences of a few years ago. I was guilty of as many misdemeanors then as the rest of you. The only saving grace in this class of cases is that it teaches us what not to do in the future. It is better for the next generation but rather hard on this one. I imagine that medical men are not different from the average individual, but the tendency of all human beings (usually attributed to be particularly true in medicine) is to go to extremes. Here is an instance where we have been led to extremes by an Englishman. It was not so bad in going to extremes when we were tacking up stomachs, transverse colons, etc., because we did not sacrifice lives in doing it, but when it comes to a matter where many lives or patients' comfort have been sacrificed it seems to me that we should take heed of just such thoughts as Dr. Bevan has given us and be even more conservative in the future than in the past.

Dr. John E. Summers, Omaha:

I would like to speak of one point mentioned by Dr. Bevan: that was, opening the cecum for obstruction. When obstruction takes place, due to a newgrowth in the intestine, you do not have the acute symptoms of obstruction. If the case has gone on to the point of severe symptoms, I think the cecum should not be opened, but the small intestine, and if the case is very, very dangerous I have, of late, been in the habit of opening the small bowel high up. I use a local anesthetic and I have been much pleased with the result. I want also to make a confession. I have operated on some of these epileptics. I tried to select my cases, however. They were cases of chronic obstipation with the usual coated tongue. In some instances I have materially benefited my patients but not cured the epilepsy. So I think we should not be too rabid in our disapproval of these operations. My experience goes back as far as that of most of the people here in the room: I have operated for epilepsy, trephined, removed ovaries, etc. I think we should not be too sweeping in our criticisms of people who are working toward a goal. I appreciate what Dr. Bevan has said and in the main I agree with him but not altogether.

Dr. Willy Meyer, New York City:

I think the great majority of us have practised very rarely the operation presented by Dr. Lane. Yet we can come across patients

in whom medical men and surgeons working together have tried everything known to medicinal and hygienic regime without success. Surgical interference is clearly indicated. What are we to do in such cases? I would like to say in this respect one word in behalf of that operation which to my mind is not sufficiently often done, first introduced by Robert F. Weir: appendicostomy. I believe it ought to be done oftener in cases that will not yield to ordinary treatment; it will benefit many patients. At present we usually do it in cases of chronic diarrhea when the rectoscope has shown ulcers that involve the sigmoid and rectum. Personally I have seen splendid results in any kind of ulcerated, chronic colitis, even in tubercular cases. The main points to be observed are, to test the permeability of the appendix during the operation before closing the wound, and to make use of the entire length of the appendix with its meso-appendix. If on testing the permeability of the appendix with flexible bougies, after the suture of the wound has been completed, an obstruction cannot be overcome, it is a simple matter then to reopen the wound, remove the appendix and perform cecostomy. By using this method in cases of chronic constipation that will not yield we will, I feel sure, benefit many patients. To show how nicely intestinal auto-intoxication with visible results can be overcome by means of regular irrigation of the large bowel from above, I would mention one case where such a patient with a chronic, ulcerative colitis had an obstinate chronic skin lesion that disappeared quickly and permanently under this treatment.

Dr. Samuel J. Mixter, Boston:

I wish to thank Dr. Bevan for his paper which is so timely and so true. He said something about adhesions. I think we should distinguish between trouble caused by adhesions and the ordinary intestinal stasis of the neurotic, apparently not due to mechanical causes. I do believe in operating on adhesion cases, for some of the most satisfactory results that one obtains are in these. Operation does not always cure, but it does cure some and improve a great many. Another point that should be emphasized is that a patient should not be operated on just because it is said that medical means have failed. Why should a medical man or the patient expect the surgeon to do the impossible? Exploration is a first-rate thing in certain cases, but when the internist insists on an exploration, a surgeon is mighty apt to do something against his best judgment. In regard to the excision of malignant growth at the rectosigmoid junction: mortality is very high. Whenever we try to unite the intestine at this point, we are bound to have a certain number of failures. The rule that I make is always to tell the patient that if he wants to take the best

chance of getting through with his life, getting rid of the disease and irritation, he must be willing to go with an artificial anus the rest of his life, and then the patient has a right to choose either to take the greater risk for the more perfect result or have a safer operation that will leave him with an artificial anus.

Dr. Arthur D. Bevan, Chicago (in closing):

I am very optimistic about the splendid progress being made in medicine and in surgery. I believe that the time has come when we can say without hesitation that the big important problems in medicine today and the most important research is clinical research of the best type. These problems that are brought to us by sick and suffering humanity —these problems in clinical surgery—should, I think, be looked upon, not as belonging to a narrow field, but should be, as I suggested, attacked by a number of men from different points of view. That is the one moral that stands out in the analysis of a situation of this kind.

In order to prevent what I think we are all willing to admit have been mistakes we should look upon new fields as new pieces of clinical research in which we want to solve the problem not alone but where we want the assistance of our colleagues in different branches, who might assist us in solving it in the right way.

THE REPAIR AND RECONSTRUCTION OF THE HEPATIC AND COMMON BILE DUCTS

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The consideration of the treatment of benign stricture of either or both the hepatic and common ducts, due to partial or complete obliteration of their lumen, is most interesting, for it frequently directly concerns the ability of the surgeon to replace the damaged segment of the duct with a new channel, with the hope and, possibly, the expectation that it shall permanently serve the purpose of conducting the bile into the intestine.

While the methods of duct reconstruction, adopted after excision of a malignant growth at the papilla or more rarely in the supraduodenal part of the duct, do not differ essentially from those employed for the relief or cicatricial stricture, the almost inevitable recurrence of the growth and the subsequent death of the patient, which takes place before the end-result becomes established, and consequently before the permanency of the new duct can be definitely determined, warrant the exclusion of the consideration of this particular group of cases at the present time.

Benign strictures ordinarily follow the healing of an ulcer, the result of pressure of a stone, or of subcutaneous trauma, or, much more commonly, the result of unrecognized division or excision of a segment of the duct in the course of a cholecystectomy or difficult choledochotomy. They may also follow an infectious cholangitis terminating in necrosis of the mucous membrane of the duct, in which event the larger portion of the duct may become stenosed or obliterated.

The study of case reports shows numerous instances of strictures due to damage to the junction of the cystic and hepatic or to the hepatic or common duct alone in the course of a cholecystectomy. If recognized immediately the defect can usually be satisfactorily and easily repaired, otherwise stricture is almost certain to develop and the necessary operation for its relief becomes much more difficult and dangerous. For this reason it is advisable to briefly state the conditions which predispose to this accident and to suggest measures by which it may possibly be avoided.

The following anatomical and pathological predisposing factors must be emphasized:

(*a*) An abnormally short cystic duct and a correspondingly short pedicle.

(*b*) An abnormal course of the cystic duct in that it runs parallel to and sometimes closely united to the hepatic duct for a considerable distance above the junction. Rarely the cystic duct crosses the hepatic duct to open on its mesial aspect.

(*c*) The pathological predisposing causes include a shortening of the gall-bladder pedicle from the extensive contraction of long-standing inflammatory adhesions or a pedicle materially shortened by an unsuspected dilatation of a considerable portion of the proximal portion of the cystic duct.

(*d*) In a number of instances damage to the hepatic or common duct has resulted from the effort of the surgeon to secure with a hemostat a retracted bleeding cystic artery. The attempt is successful, but at the expense of including a portion of the duct wall in the grasp of the forceps. A peculiar friability of the tissues forming the gall-bladder pedicle, which is sometimes found in cases of long-standing cholelithiasis, predisposes to this accident through the cutting through of the ligature. In one instance of this kind the writer secured satisfactory hemostasis only by the application of a purse-string ligature in which both the divided end of the duct and the adjacent cystic artery were included.

(*e*) The obliteration of all anatomical landmarks, including the foramen of Winslow through extensive adhesions naturally increase the likelihood of injury to the ducts.

(*f*) A thick abdominal wall or an overhanging right lobe of liver.

To obviate, so far as possible, the risk of damage to the ducts in operations for long-standing cholelithiasis the operative field should be exposed through an adequate incision and the relation of the duodenum, colon, omentum, and stomach restored to their normal position by careful separation of all adhesions. It is also essential that the gastrohepatic omentum and the foramen of Winslow should be identified. In this connection the hepatic artery may be of considerable assistance. These preliminary steps once accomplished the nature and location of the lesion may usually be readily determined and the appropriate remedy applied. In the event of a choledochotomy an instrumental guide introduced into the duct after the removal of the calculus and passed upward into the hepatic duct will avert all risk of damage to the ducts when the pedicle of the gall-bladder is ligated. In routine cholecystectomy the identification of the junction of the hepatic and cystic ducts is essential. The cystic duct should then be divided and the plane of dissection deepened as closely to the gall-bladder as possible. The cystic artery and other vessels should be secured by a number of small rather than by one large clamp. In difficult cholecystectomies the gall-bladder may be opened, emptied of its contents, and the dissection of this organ from contiguous structures facilitated by the introduction of a finger into its cavity. Preferably the gall-bladder is removed from below upward. If removed in the opposite direction similar precautions should be observed as its pedicle is approached. In every case traction of the pedicle must be avoided, as it produces angulation of the junction of the cystic and hepatic ducts and thereby predisposes to their accidental division. After the removal of the gall-bladder the divided pedicle should be carefully inspected and the small circular orifice of the cystic duct identified. If two orifices are

seen the "hepatocommon" duct has been completely divided. If the orifice of the divided cystic duct has a decidedly oval shape a partial circumferential excision of the hepatic or common ducts may have occurred. In either event prompt recognition of this accident leads to its immediate repair and decreases the risk of a stricture and the necessity of a secondary operation.

The writer has collected 7 instances of excision or ligature of small portions of the duct wall, of which 5, reported by Kehr, were treated satisfactorily by drainage with a T-tube. In one of the remaining 2, reported by Brewer, the junction of the cystic and hepatic ducts was ligated in the course of a cholecystectomy in such a way as to diminish, by one-third, the duct lumen. The ligature was left *in situ* without untoward result. In the other, one-third of the duct wall was excised in the removal of an adenoma with immediate suture. In none of these cases was subsequent stricture observed.

The reports of 23 cases of end-to-end suture of the duct were gathered by the writer from the literature and from personal communication. In 10 of these a primary end-to-end suture was done, the longest interval bridged being two inches (Kehr). In this case, however, a stricture developed at the end of two months and a secondary end-to-end suture was done after excising 2 cm. of cicatricial tissue. The patient was free from recurrence five months afterward. In the remaining 13 end-to-end suture was done after a resection of a stricture. The longest interval bridged was 3 cm. in a case reported by Riggs after excision of a stricture at the junction of the hepatic and cystic ducts. In this case there had been no previous operation. The patient was well four and a half years afterward.

These 23 cases include four failures, one by Nordmann in which jaundice recurred seven weeks after the immediate suture of the ends of a divided duct in the course of a cholecystectomy. The recurrence was relieved by a suture of the hepatic stump to the duodenum. The second failure is reported by Kehr, in which recurrence followed the treatment of a defect in the

hepatic duct by the Heineke-Mikulicz method. In the third failure, reported by Lyle, recurrence took place two and a half years after operation. This was relieved by resection with end-to-end suture. The fourth failure is reported by Wilms. (See Case Report.)

In these 23 cases the tube, over which the anastomosis was usually made, was either left to itself, removed by forceps, or brought out through a separate incision in the duct wall below the point of suture or through an opening in the wall of the duodenum. In one case (Jackson) the patient was in excellent condition at the end of sixteen months save for occasional attacks of slight jaundice with epigastric pain.

While stricture almost inevitably follows division or excision of a segment of the duct, a linear incision through its wall, such as is made in choledochotomy, usually heals without complication. One case, however, is reported by Kehr in which a slight linear defect was followed by stricture, although an associated trauma to the main duct below is said to have been a chief contributing factor. In this case changes of a keloid character may have developed in the duct scar. Such a change, perhaps, may take place where, following unduly prolonged drainage, a scar of considerable size is left in the wall of the duct. Whether, after a choledochotomy, the pressure of the drainage tube predisposes to necrosis of the duct wall either at the point of its exit or in some more remote portion of the duct is doubtful, provided that a soft, flexible tube that does not completely fill the lumen of the duct is used. A moderately sized Nélaton catheter fulfils these conditions, and in a number of instances has remained for months *in situ* without causing any damage.

The symptoms of cicatricial stricture of the hepatic or common duct are late in their development. The stricture must be far advanced before the resulting stenosis, without associated inflammation will be sufficient to cause jaundice. There is usually the history of a long-standing cholelithiasis with one or more operations, especially that of cholecystectomy. It is important

to note, however, that a stricture of this kind may develop without the history of this or of any other operation, or in case of previous operation that the stricture may be situated in such a remote part of the duct as to be in no way connected with it. In these cases of primary stricture the symptoms include a gradually developing jaundice with or without occasional attacks of cholangitis, during which the jaundice becomes more intense. Pain is not a marked feature and attacks suggesting a common duct stone are exceptional. In some cases physical examination discloses a moderate increase in the size of the liver and signs of peritoneal irritation may be elicited only during the attacks of cholangitis. If the condition is not relieved the terminal symptoms are those of cholemia with or without infection in the parenchyma of the liver itself.

The treatment of cicatricial stricture of the hepatic or common duct depends upon its location and extent and perhaps, in a slight measure, upon the condition of the gall-bladder. One of the earliest arguments against cholecystectomy and in favor of cholecystostomy was that the sacrifice of the gall-bladder made a future cholecystenterostomy impossible, an operation which, theoretically at least, would be indicated for the relief of benign stricture in the common duct, provided that the hepatic and cystic ducts and the gall-bladder were normal. Unfortunately, however, these conditions are rarely fulfilled for benign stricture of the common duct, in itself a lesion of long-standing cholelithiasis, is usually associated with a stenosed or obliterated cystic duct, and a gall-bladder so atrophied and thickened that it has long since ceased to perform its normal function. Under such conditions it is quite obvious that cholecystenterostomy is impracticable, while in stricture of the hepatic duct only it would of course be useless.

Exceptionally favorable anatomical conditions exist for the successful performing of this operation as is shown by the 3 cases reported respectively by Mariani (biliary fistula, following cholecystostomy anastomosed to the pylorus; patient well two years after), Körte (duodenocholecystostomy for apparent

stricture of the papilla; recovery), and Kausch (cholecystenterostomy for supposed cancer of the pancreas; death three months later from infectious cholangitis. Autopsy disclosed a chronic pancreatitis causing a benign stricture). The case reported by Kausch illustrates the danger, that of an ascending infectious cholangitis, to which these patients are exposed, and which is probably rendered more likely by any stasis, even though it be temporary, of the flow of bile. To avert this danger Krukenberg has suggested a rotation, around its vertical axis, of that part of the gall-bladder that is used for anastomosis; Maragliano has established an enteranastomosis and has used the excluded loop for the cholecystenterostomy, while Montfrofit, has, after dividing the jejunum, approximated its lower end to the gall-bladder, the continuity of the intestine being reëstablished by a lateral anastomosis of the two segments of the intestine below the site of the cholecystenterostomy. The fact that none of these measures provides a satisfactory safeguard against ascending infection perhaps justifies in all cases of benign stricture the selection of some operation after which the flow of bile into the intestine is more constant than after a cholecystenterostomy, reserving this latter operation for the temporary relief of obstruction in inoperable cancer of the papilla or head of the pancreas.

The extent and location of the benign stricture is of great importance in determining the selection of the appropriate remedy.

(*a*) Stricture situated in either or both hepatic and common ducts in which the duct above and below is relatively normal and surgically accessible.

(*b*) Stricture situated in the lower end of the common duct including the orifice at the papilla.

(*c*) Strictures situated in that part of the hepatic or of the right and left hepatic ducts which are covered by liver tissue, and in which, therefore, the dilated duct above is surgically inaccessible.

The treatment of strictures belonging to the first group includes:

(*a*) The linear division of the stricture. The stricture in Case I herewith reported was treated by the writer in this way, not with the expectation of effecting a permanent cure but with the hope that after the subsidence of the jaundice the improved condition of the patient would permit of some form of anastomosis between the stump of the hepatic duct and the intestine. After three and a half months the complete biliary fistula suddenly closed twenty-four hours before the time set for the anastomosis. Unfortunately at the end of a year the patient unexpectedly moved away and every effort to trace her failed. During this interval and about six months after the closure of the fistula, she had had one attack of slight jaundice of several days' duration.

This method is quite analogous to that employed in an external urethrotomy, and if postoperative passage of sounds were possible might be expected to yield equally satisfactory results. Division of the stricture only, however, cannot be expected to give permanent relief. Ultimately recurrence would appear inevitable. There is practically no evidence by which any adequate estimate of the length of the period of relief may be made. In the present instance no symptoms of recurrence had appeared one year after the operation. How much longer this favorable condition continued is uncertain. In spite of every effort to keep the patient under observation she unexpectedly left the city for Canada and no word has been received from her since. Her name is given in the hope that she either has or will seek the counsel of some surgical friend and thus permit the completion of her history.

While simple division of the stricture may give temporary relief, some attempt to supplement the procedure by reëstablishing the continuity of the duct is unquestionably indicated. Although, as in Case I, reported by the writer, the discharge of the entire liver secretion did not affect the general condition of the patient in a detrimental way, it has been clearly shown by Seidel that osteoporosis with subjective symptoms of pain and weakness develop when the biliary fistula is permanent. In one

instance where a biliary fistula had existed for three and a quarter years, autopsy showed an osteoporosis of the entire skeleton. The same writer reports a second observation in which a similarly extensive osteoporosis, appearing two years after the formation of a biliary fistula, increased in intensity during the following two years and subsided only after the fistula had closed. In Case I the operation was done in 1907, and at that time duct reconstruction was in its infancy, while the patient's condition did not warrant an attempt to establish an anastomosis between the stump of the duct and the intestine. The most simple measure and probably the one which gives the most satisfactory result is resection of the cicatricial tissue followed by end-to-end suture of the divided ends. If the accidental excision of a segment of the duct in the course of a cholecystectomy is immediately recognized the respective ends of the divided duct are easily freed from contiguous tissues and an interval of from 1 to 2 cm. bridged over by their anastomosis without undue tension. On the other hand, after stricture develops, identification and mobilization of the ends of the duct become much more difficult and may render some other form of duct reconstruction necessary. Yet, even under such unfavorable conditions a considerable interval—in one instance reported by Kehr of two inches—may be successfully bridged in this way. In other cases the dense and consequently unyielding character of the cicatricial tissue or its peculiar friability or the length of the stricture proper forbid an attempt to secure end-to-end anastomosis and compel the adoption of other means to restore duct continuity.

In these cases, after the excision of the cicatricial tissue a new channel between the exposed orifices of the duct must be provided in the hope that, ultimately, it will become lined with epithelium and thereby remain permanently patent. The most simple means to attain this result is to introduce a rubber tube into either orifice of the duct with the expectation that the granulation tissue which ultimately invests the tube will, when the tube is removed gradually, become converted into a satis-

factory channel which, even though contraction ensues, will yet remain sufficiently patent to convey the bile into the intestine. Verhoogen reports a patient treated in this way who was in excellent health eleven months after the operation; a patient operated on by Propping developed prompt recurrence; while in Kehr's case the end-result is not mentioned.

In two instances the missing part of the duct has been supplied by using the biliary fistula, in one by von Stubenrauch who anastomosed it with the duodenum (failure through necrosis of the fistulous tract), and a second case in which Murphy invaginated the biliary fistula directly into the exposed end of the common duct. In this case the patient remained free from recurrence for eight months but ultimately died in a condition of advanced jaundice, refusing hospital aid. Probably other methods of duct reconstruction are preferable to those just mentioned. The following procedure has yielded good results: The posterior edges of the divided ends of the duct are anchored to the adjacent tissue of the gastrohepatic omentum with chromic catgut sutures. In this way their relative position is kept constant. A soft Nélaton catheter is then introduced into the duct above and below, if possible through the papilla into the duodenum. The exposed portion of the tube indicating the length of the new channel, is then covered in by the superposition of a visceral pedunculated flap from the adjacent wall of the stomach or duodenum or gall-bladder (in one case (Kehr) by a portion of the cystic duct remaining after the removal of the gall-bladder) or the defect may be covered by a detached facial flap (Ginsburg and Speese) or by omentum or by bringing over the tube with Lembert sutures the adjacent posterior parietal peritoneum. This last method, using plain catgut sutures and reinforcing the suture line with superimposed omentum, is preferred by the writer. The use of omentum alone has not given satisfactory results, although in animal experimentation it has been employed successfully for the repair of defects in the gall-bladder. The unsatisfactory results in the few cases in which this method has been employed in duct recon-

struction may have been due to its inherent mobility as well as to the mobility communicated to the omentum and the peristaltic movements of the transverse colon. Free movements of this kind might interfere with the stability of the sutures and with the subsequent patency of the new duct. Flaps from adjacent viscera should not include the mucous membrane for the reason that pathological bacteria on its surface may predispose to an ascending infectious cholangitis while subsequent leakage may follow faulty repair of the visceral opening. Gall-bladder flaps with the mucous membrane turned toward the interior of the reconstructed duct are said to predispose to the formation of new calculi. It must be remembered that any flap prolongs the operation, and that in cases in which the general condition of the patient is seriously impaired some short and simple method of duct reconstruction is preferable.

The problem is much more complex in strictures involving the end of the common duct. Here relief can be afforded by direct anastomosis between the dilated duct above the point of stricture with either the stomach, duodenum, or small intestine or by the formation of a new channel, with the assistance of a soft-rubber tube, which, fastened above into the end of the dilated duct, is carried through a new opening in that part of the alimentary canal which, under favorable conditions, would have been selected for direct anastomosis. This form of duct reconstruction must be employed when the stump of the hepatic duct is very short, when the intestine is so firmly fixed by adhesions that direct anastomosis would be impossible or, when the necessary apposition would cause so much tension that subsequent leakage would be likely to occur.

The anastomosis of the stump of the divided duct to some part of the alimentary canal was done in 6 cases with the stomach, in 14 with the duodenum, and in 6 with the jejunum. Of 4 cases of anastomosis with the stomach 1 (Dujarier) was in excellent health and another (O'Day's) six years after the operation. In Kehr's case the operation was followed by both biliary and gastric fistulæ, of which the latter closed only after

the expiration of eleven years. Of the 7 cases of anastomosis of the stump of the duct to the duodenum Summer's case was well seven years, Bazy's and Mann's four, Crile's three, and Wilm's fifteen months after the operation. Duodenal fistulæ developed in the case of Losser, in which it closed spontaneously in three weeks, and in the case of McGlannan in which a biliary fistula developed as well, a fatal termination ensuing.

Subsequent attacks of slight jaundice and epigastric pain after the recovery of the patient were mentioned in the cases of Mann and Bottomley.

Of the cases of anastomosis of the duct and jejunum, Kausch reports a patient well one year, and Jackson one free from jaundice or other symptom of recurrence when the patient suddenly died eleven months after operation from secondary gastric carcinoma.

Eighteen cases of duct reconstruction have been collected exclusive of the 2 reported by the writer. Of these in 9 the lower part of the choledochus was preserved. In the remaining 9 a new opening was made in the duodenum. In the series in which the choledochus was preserved the methods of reconstruction varied. In 3 (Verhoogen, Propping and Kehr) nature was allowed to form a new duct segment out of granulation tissue. Verhoogen's case was well eleven months after operation; Propping's patient developed symptoms of recurrence shortly after the operation and a stricture nearer the liver, discovered on opening the abdomen, was treated in the same way as the original stricture. No mention is made of the end-result in Kehr's case. Propping's case is of interest in that the segment of the duct originally reconstructed appeared normal when the abdomen was reopened.

In 5 cases after excision or division of the stricture an attempt was made to form a new channel by suture of parietal or visceral peritoneal tissue over the exposed part of the tube, introduced into either extremity of the divided duct. Of these cases, Freeman's is most interesting in that the patient dying of chronic abscess of the liver eleven months after the operation an oppor-

tunity was afforded to examine the reconstructed duct. It had considerably contracted to the caliber of a broom-straw, but had functioned satisfactorily without indication of biliary stasis. Of end-results Finney's case is noteworthy in being well two years and McRae's two and a half years after operation. In the latter case the stricture was treated by incision, dilatation, and drainage. Verhoogen and Finney mention the occurrence of slight attacks of jaundice and epigastric pain for a number of months after the patient's recovery.

In Völcker's case the tube, allowed to remain *in situ*, was found bent and displaced at a second operation for a persistent biliary fistula four months later. To prevent a similar accident the tube was brought out through the duodenum (Witzel), with excellent result.

In the remaining 9 cases a new opening in the duodenum was necessary. In 2 the exposed tube, joining the hepatic stump to the duodenum, was covered with omentum. Brewer's patient, after a temporary cholangitis with jaundice, promptly developed a recurrence and succumbed to an operation for its relief. In Terrier's case the recurrence was successfully relieved by an anastomosis between the duct and duodenum. Sullivan, to whom credit is due for the invention of this operation, reports a patient, aged sixty years, well and attending to the work of an engineer four years after the operation. An equally satisfactory end-result was obtained by Jenckel, who bridged by this method an interval of 8 cm. This patient developed a duodenal fistula during convalescence which ultimately closed. After recovery patient suffered from occasional attacks of colic. Wilms reports 4 cases. In the first a slight biliary fistula persisted and the patient suffered from occasional attacks of pain in the right hypochondrium. The second case was complicated during convalescence by a duodenal fistula which required a jejunostomy for its relief. The catheter was discharged from the wound on the eleventh day. Save for a slight biliary fistula the patient was well fifteen months after the reconstruction. In the third case, after vomiting, a short time after the operation a large

amount of bile (proving the patency of the tube), a biliary fistula developed which was found on exploration, three weeks after the primary operation, to have been the result of the displacement of the tube out of the hepaticus. The tube was then sewed in. Two months later it was vomited. In the fourth case, after end-to-end suture over a tube of the ends of the duct divided in the course of a cholecystectomy, a persistent biliary fistula developed which was found to have been the result of the angulation of the tube and a consequent separation of the ends of the duct for a distance of 2 cm. A Völcker transduodenal operation then failed to relieve the jaundice, and after an interval of seven months a Wilms operation gave relief for several months, at the end of which time the tube was vomited and the jaundice immediately reappeared. At a fourth and final operation the jaundice was relieved by a Wilms operation, a new duct being reconstructed between the hepatic stump and the stomach.

The dangers common to either or both of these procedures include:

(*a*) Leakage of intestinal contents into the peritoneal cavity directly or after the retraction of the implanted end of the duct.

(*b*) Regurgitation of intestinal contents into the newly formed duct channel.

(*c*) Ascending infectious cholangitis with liver abscess.

Leakage from the retraction of the implanted duct may be prevented by the suture of the end of the duct through a separate transverse opening in the duodenum to the mucous membrane below the opening through which the duct enters the intestine. The additional duodenal opening is then closed in the usual way and the duct sutured to the outer wall of the duodenum at its point of entrance. The wall of the duodenum is then still further infolded upon the terminal part of the duct.

The danger of ascending cholangitis varies directly with the distance from the site of the papilla at which the new opening into the intestine is made. It is therefore least frequent when

the opening is made into the stomach near the pylorus or into the upper part of the duodenum. The risk of this complication, as well as the risk of subsequent regurgitation of intestinal contents, is materially decreased if the end of the divided duct or the rubber tube, in case of duct reconstruction, is passed obliquely (Witzel) through the visceral wall. It is only in the rare side-to-side anastomosis that oblique implantation cannot readily be carried out. (The risk of postoperative leakage and the subsequent formation of a duodenal fistula is also diminished by this procedure.) It is for the purpose of still further decreasing the risk of these postoperative complications that provision is made for the insertion of the end of the divided duct or (in case of reconstruction, of the rubber tube) into a portion of the small intestine which has been excluded from the path of intestinal contents, either by simple enteranastomosis or by the more complicated procedure in which the intestine is first divided, and after the closure of the oral stump the continuity of the intestine is restored by lateral anastomosis a short distance below the point of division. The excluded intestine, two or three inches in length above the lateral anastomosis, is then utilized for the entrance of the divided duct or rubber catheter as the case may be. While the advantages of this method are evident it must again be emphasized that frequently the general condition of the patient does not permit prolonged operation and that a long preëxisting jaundice, predisposing to parenchymatous postoperative hemorrhage, is not conducive to extensive repair. As a matter of fact, while experience, as yet, is not sufficient to determine the choice of any special method, sound judgment would seem to warrant the selection of the more simple rather than of the more complex method except in those cases in which the patient still has abundant vitality. In many cases in which the adhesions are so numerous and baffling that a considerable time is required to adequately expose the region of the stricture, it is wise to do the operation in two stages: the first having for its object the establishment of a satisfactory biliary fistula, and the second, done only after jaundice has

disappeared and the general condition of the patient has improved, for the purpose of effecting duct reconstruction.

Whatever the method adopted, the first step in all operations is identical, namely, to expose and identify the duct above and below the stricture. This is usually difficult on account of the obliteration of anatomical landmarks by adhesions, and is consequently fraught with the danger of visceral and vascular damage. The goal to be attained is the gastrohepatic omentum with the foramen of Winslow, and the guide which the writer, especially in the absence of the gall-bladder, has found most serviceable is the under surface of the liver and especially the sulcus originally occupied by that organ. From this surface all adhesions, including those binding the omentum to the stomach, duodenum, and colon, are carefully separated, keeping close to the liver until its transverse fissure is reached. Separating at first with considerable difficulty and requiring the ligation of numerous bleeding-points the adhesions yield much more readily as the transverse fissure is approached. With the exposure of the gastrohepatic omentum the pulsation of the hepatic artery forms a valuable guide to the position of the dilated duct. The identification of the collapsed duct below the stricture is much more difficult, but the upper border of the duodenum and the edge of the gastrohepatic omentum are of material assistance in facilitating its exposure. In all strictures in which the ends of the duct are separated by an appreciable interval the duodenum should be mobilized. This maneuver, in some cases, will permit an end-to-end anastomosis of the ends of the duct without tension, while in others it will render possible an end-to-side anastomosis of the hepatic stump and duodenum.

The disposition of the Nélaton catheter used in cases of duct reconstruction is of great interest. By some it has been left *in situ*, and in these cases it has either been ultimately passed in the stool, or after remaining *in situ* several months it has been vomited or it has become displaced or angulated in such a fashion as to block the flow of bile. By other surgeons some device has been employed by which, after a certain length of time, that

tube has been removed. This may be accomplished by the use of a T-tube, the vertical portion of the tube being left out of the wound at the end of the operation, or the vertical part of

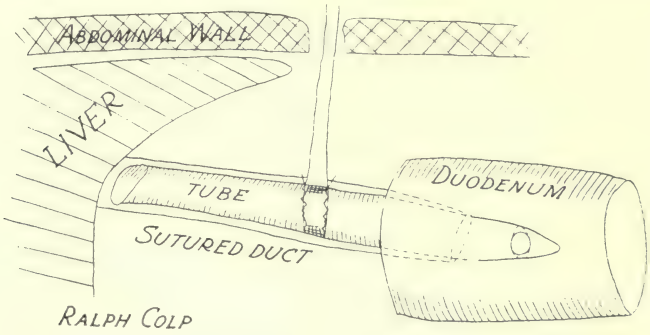

FIG. 1

the tube may be supplanted with two loops of stout silk tightly embracing the catheter in the reconstructed part of the duct and emerging from it between two catgut sutures. At the end

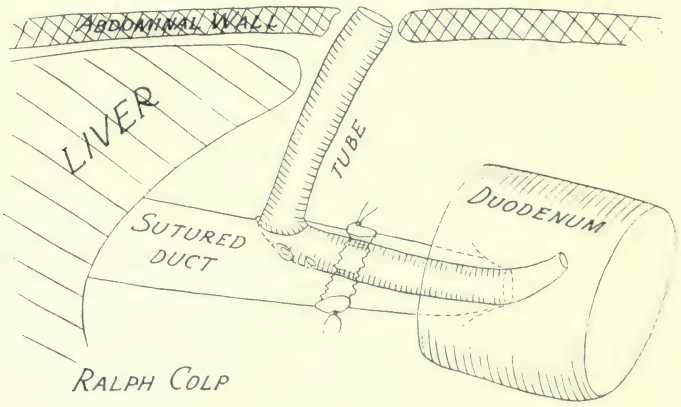

FIG. 2

of a variable period the tube is withdrawn by gentle traction on these loops. Völcker objects to this procedure because of the damage inflicted by the withdrawal of the tube on the wall of

the newly reconstructed duct, and to obviate that disadvantage the extremity of the tube is brought out obliquely through the

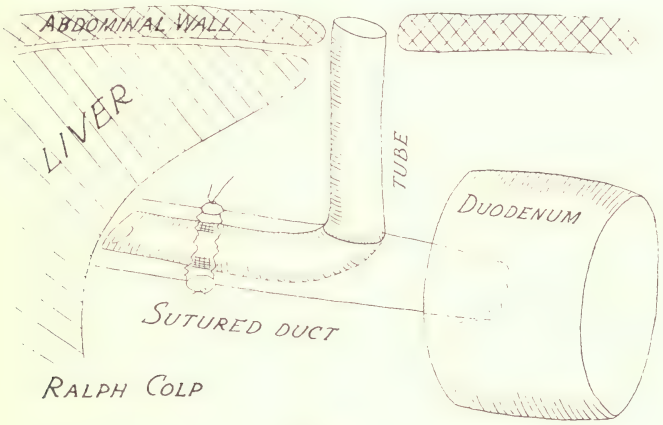

FIG. 3

wall of the duodenum a short distance below its point of entrance, and then together with the drain through the abdom-

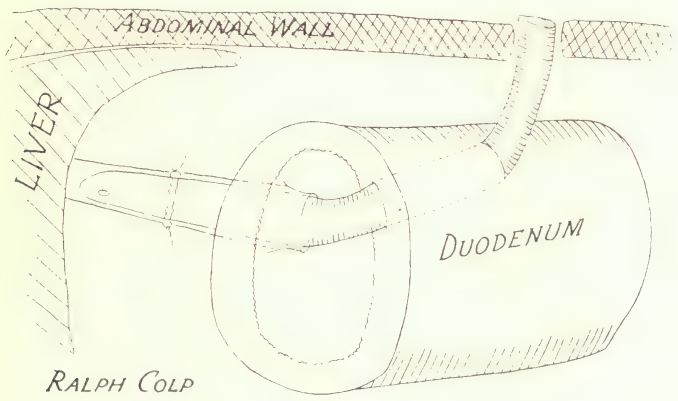

FIG. 4

inal incision. At the end of ten to fourteen days the tube is removed and not replaced and the oblique small opening in the

duodenum promptly closes. If the common duct below the point of repair is normal and accessible, Völcker prefers to bring out the tube through a small opening in the duct rather than through the duodenum. Other observers have practised the withdrawal of the tube through a small opening in the wall of the hepatic duct above the reconstructed segment. Either of these measures seems preferable to the withdrawal of the tube through an opening in the duodenum, subject, as it undoubtedly is, to the possibility of a duodenal fistula. In fact, in at least one instance, reported by Völcker, this disagreeable complication has occurred, although fortunately it closed spontaneously without detriment to the patient. In the writer's second case, after reconstruction of the duct by the use of the posterior parietal peritoneum, the tube was withdrawn without difficulty four and a half weeks after the operation by gentle traction on the silk ligatures. That this occasioned slight damage to the wall of the newly reconstructed duct is evidenced by the fact that its withdrawal was followed by the discharge of a very small amount of bile which continued for twelve hours and then completely and permanently ceased. Whether, then, the use of this method favors in any way the recurrence of the stricture must remain doubtful. Theoretically, at least, the scar which ultimately closes the opening through which the tube has emerged is more advantageously placed either above or below than in the constricted portion of the duct itself.

The period during which the tube should remain in the duct varies very materially. By some, as has been mentioned, no attempt is made to remove the tube and it is supposed to remain permanently in the biliary channel if not vomited or passed by the stool. By others provision is made for its removal in from ten days to five weeks after the operation. The writer believes that if the tube is left *in situ* from for four or five weeks the process of epitheliazation is more advanced, and consequently the danger of a recurrence of the stricture correspondingly less than in those cases in which it is left in for a shorter time. While the tube is *in situ* the bile either flows through it or alongside

of it into the intestine or out through a biliary fistula in the abdominal incision or in both directions simultaneously. The tube should be of sufficient size to moderately fill the duct without undue distention. Its possible dislocation should be prevented by chromic gut sutures between it and the edges of the duct orifices.

Stricture of the hepatic duct so situated that the dilated duct above lies entirely within the transverse fissure, and therefore is inaccessible to the surgeon, presents a most difficult problem. The obstacle can be relieved by hepatostomy, a biliary fistula being made by puncture of the liver parenchyma with the actual cautery. Subsequently the tract of the biliary fistula can be carefully dissected out and anastomosed to some part of the intestinal canal, or both steps can be done in one operation, the intestine being anastomosed directly to the punctured liver tissue or the liver tissue may be punctured by the cautery through the contiguous wall of the gall-bladder, utilizing the opening through which this is done for subsequent anastomosis with the intestine. A successful case treated in this way by Scheidler was well five months after the operation. Anastomosis directly of the duodenum to the punctured liver tissue has been done successfully by Doberer, who makes no mention of the end-result, and by Garré. In this instance, a boy, operated on for traumatic subcutaneous stricture of the hepatic duct, was in excellent health three years afterward. Whether, in this case, the hepatic duct remained permanently obliterated or whether, as some have suggested, it again became patent, is a question that only autopsy could decide. Experimentally it appears impossible to prevent granulation tissue from blocking the mouths of the smaller biliary passages that have been opened by the actual cautery and so from obstructing the flow of bile. That such openings may remain permanently open in the human species, however, is shown by the case of Laméris, who had an opportunity of examining the condition of the anastomosis eight months after hepato-enterostomy for obstruction of the hepatic duct. In this case there were ten small openings leading into

the intestine from the right lobe of the liver (lined with cylindrical epithelium), from which bile could be made to exude by pressure. The patient had died from multiple infection of the liver, so that this operation is subject to the same danger of an ascending cholangitis as any other variety of anastomosis between the gall duct, gall-bladder, and intestine. On the other hand, the experience of Kausch who, after a successful hepatostomy, was obliged, at intervals of from ten to fourteen days, to remove the granulations from the surface of the liver in order to effect a renewal of the flow of bile, demonstrates that a biliary fistula established in this way is not always permanent. To account for the evident discrepancy in the result of this operation the writer suggests that the biliary fistula may be temporary when the patency of the hepatic duct becomes reëstablished, but that if the hepatic duct is completely obliterated the intrahepatic biliary pressure may be sufficient to insure permanently the flow of bile through the new channels which hepatostomy provides. But even if biliary fistula made by puncture or by division of liver tissue are only temporary the operation may yet prove of decided benefit by relieving a congested condition of a stricture in an inaccessible hepatic duct while the liver fistula may remain open sufficiently long to permit the reëstablishment of a biliary fistula in communication with the duct and, as in at least one instance, to provide in this way an outlet for the discharge of calculous material by which the duct was obstructed. Thus, in the case reported by Cohen a hepatostomy was done for jaundice persisting after a cholecystectomy in which the duct was inaccessible. After forty-eight hours the liver fistula discharged copiously and continued to do so for twenty days. Then bile passed into the intestine and the original fistula remaining after the cholecystectomy discharged a large amount of calculous material and shortly after closed, the liver fistula having previously closed as soon as the duct again became permeable.

The discussion of benign stricture of the common and hepatic ducts in this paper has referred to a lesion in the final stage of

its development. The stenosis must be extreme to seriously interrupt the flow of bile into the intestine. Were the bile duct as accessible to examination as the urethra the sequential development of the symptoms of stenosis, together with the essential principles of their treatment, would have become thoroughly standardized. As it is the clinical features, in primary cases, are not easily differentiated from those of stone in the common duct even in the stage of permanent jaundice, and it is for the removal of a supposed stone that the operation usually is undertaken.

It is only as a lesion associated with stone that partial stricture of the duct is occasionally observed by the surgeon. Whether such a stricture requires special treatment is not always easy to decide. Usually the removal of the stone or stones leaves the duct in such a condition that any further increase in the degree of stenosis is improbable. When a small part of an accessible portion of the duct is involved in this way, and the stricture is composed of dense cicatricial tissue and is annular, its resection with end-to-end anastomosis is justifiable. Strictures in the lower inaccessible portion of the duct at or near the papilla, the presence of which are suspected because the passage of an instrument through the opened duct into the duodenum is impossible, do not ordinarily justify duct reconstruction. Usually such strictures are due to the inflammatory swelling and edema of an associated cholangitis which the removal of the calculus and the subsequent postoperative biliary drainage relieve. On the other hand, the failure of bile to flow after the removal of a calculus in the hepatic duct is evidence of a stenosis which demands immediate relief, and the operation should not cease until an ample flow of bile is secured. Sometimes a stenosis is due to the presence of a second calculus higher up and sometimes to cicatricial stricture. In the latter event endeavor should be made to pass a probe through the stricture to be followed either by its division or, if situated within the liver tissue, by its dilatation with long, slender forceps. A lesion of this kind, herewith reported, has recently been treated by the writer.

The stricture, situated in the duct within the transverse fissure, was treated in the manner just described by dilatation, followed by the establishment of an ample biliary fistula and a disappearance of the jaundice. Apart from a subdiaphragmatic abscess the postoperative course was thoroughly satisfactory. Four weeks after the operation the stools contained a considerable amount of bile, although much was still discharged through the fistula. The patient ultimately succumbed to pneumonia, fifty-six days after operation, the biliary fistula having been closed for several weeks. (See Case III.)

Any comparison of the relative value of the methods of duct reconstruction is very unsatisfactory. The question as yet unanswered is that of the possibility of the production of an epithelial lining for the new passage-way. If this actually takes place it may be expected, with reasonable assurance, that a lining of this character will provide a safeguard against a recurrence of the stricture. Unfortunately this question must still remain doubtful, for its solution could only be supplied by the actual microscopic examination of the lining wall of the new channel after operations for duct reconstruction, where the patient has remained free from recurrence sufficiently long to be considered a permanent cure. A careful search of the literature has failed to reveal any evidence of this kind.

Apart from the necessity of providing, if possible, a channel which will not materially contract, the advantages of utilizing the terminal part of the common duct are quite evident. A normal papilla is in itself the best safeguard against intestinal ascending infection and its sphincteric control of the bile into the duodenum cannot be imparted to any artificial opening no matter how skilfully made. Furthermore, the dangers of duodenal leakage or of regurgitation of intestinal contents into the newly reconstructed duct are naturally avoided if the wall of the duodenum remains intact. When, however, the lower part of the common duct is the site of stricture a new opening in the duodenum is unavoidable. In that event it is the writer's belief that end-to-end anastomosis between the dilated duct

and the duodenum through an oblique (Witzel) opening in its wall will prove the method of choice. In all cases in which pathological conditions preclude direct anastomosis an effort should be made to reconstruct the duct by means of a rubber tube which, sutured by absorbable material to the duct wall (and covered by the contiguous visceral or parietal peritoneum), is passed obliquely into the intestine or stomach as near the papilla as possible.

CASES REPORTED BY WRITER

CASE I.—Gussie Schwartz. Admitted to the Presbyterian Hospital November 27. Patient had typhoid at twelve. Five months ago patient first had cramps in the right upper quadrant, radiating at times upward along the anterior chest wall. These occurred three or four times a day, and were associated with vomiting, constipation, and clay-colored stools without jaundice.

Physical Examination. The physical examination showed slight rigidity and marked tenderness in the upper right quadrant, with a sense of a mass in the neighborhood of the gall-bladder. A cholecystectomy was done by another surgeon for a chronically atrophied gall-bladder filled with stones. For a month after the operation there was profuse biliary discharge, the jaundice which had developed prior to the operation decreasing but not disappearing. Six weeks after the operation the biliary fistula had closed and the patient was entirely free from jaundice and left the hospital.

Six weeks later the jaundice again appeared and has since increased without pain, but with some epigastric distress. On examination there is slight tenderness on deep pressure in the upper angle of the scar. The jaundice is intense and deepening. The stools are clay-colored. The time coagulation of the blood is below normal and not materially affected by calcium chloride.

Under gas anesthesia the pararectal scar was excised and the incision lengthened toward the median line. The gastrohepatic

omentum, buried in adhesions, was exposed by passing slowly backward along the under surface of the liver to the transverse fissure. The common duct was then identified in its supraduodenal part and opened. A probe passed readily into the duodenum. In the opposite direction a probe encountered a stricture in the hepatic duct about one inch below the transverse fissure. For a distance of three-quarters of an inch this stricture was divided without a guide, as in external urethrotomy, opening the dilated duct close to liver tissue. This was followed by a profuse discharge of turbid bile. A rubber catheter was introduced into the hepatic duct and brought out through the abdominal incision.

After the operation the entire bile was discharged from the biliary fistula. The jaundice gradually diminished and ultimately disappeared. The stools remained clay-colored without the slightest trace of bile pigment. On one occasion the temporary blocking of the mouth of the biliary fistula caused a sudden rise of temperature, which as quickly subsided when the biliary fistula was reëstablished. There was some elevation of both temperature and pulse for several weeks after the operation. During the second and third months of convalescence the temperature and pulse were normal, the jaundice had entirely disappeared, and the general condition of the patient's health was excellent. Thirteen weeks after the division of the stricture the bile suddenly found its way into the intestine in rapidly increasing amounts, and just as the patient had consented to an attempt to establish an anastomosis between the stump of the hepatic duct and the bowel. The biliary fistula closed completely in a few days and the patient was free from both jaundice and pain.

One year after her discharge the patient, suffering from a slight attack of abdominal pain with jaundice, was readmitted to the hospital. This quickly subsided in several days with the administration of phosphate of soda. Several months afterward it was learned that the patient had moved out of the city, and she has since then failed to communicate with the hospital.

CASE II.—Mrs. F., aged thirty-one years. Referred by Dr. Austin. Admitted to the Lawrence Hospital April 7, 1915. Nine years ago, two months after a fall on the right hypochondrium, resulting in the fracture of two ribs, patient had an attack of gall-stone colic lasting half an hour and not accompanied by either nausea or vomiting. Similar attacks occurred at various intervals until three and a half years ago, when an operation, either a cholecystectomy or cholecystostomy, was done by another surgeon. The gall-bladder was buried in adhesions and convalescence was prolonged by a right-sided pneumonia and pleurisy. Fourteen months after operation a hernia first appeared in the scar, and since then has steadily increased in size.

For eighteen months after the operation patient had no further attacks of colic. At that time, however, she began to suffer from attacks of soreness in the gall-bladder region without actual colicky pain, but with chills, sweating, weakness, moderate temperature, and marked jaundice, and clay-colored stools. There was never any vomiting or gastric or digestive disturbance, and the movements of the bowels were easily regulated by salts. During the attacks the patient, a trained nurse, states that the liver seemed larger and more sensitive. Between the attacks the patient's general condition was good and her appetite excellent. She had never regained her normal weight since the operation, weighing about thirty pounds less.

Physical Examination. The physical examination showed a vertical scar in the gall-bladder region, in which is a ventral hernia the size of an orange. The abdominal wall is thin and readily permits of palpation of the liver, the edge of the right lobe being two inches below the free margin of the ribs and the left lobe being also considerably enlarged. There is slight sensitiveness in the region of the gall-bladder, and the spleen is also palpable and tender. There is no marked jaundice nor any large amount of bile in the urine, but the skin is very sallow. The leukocytosis is not increased.

Under ether the abdominal scar was excised and the edges of the abdominal aponeurosis freshened preparatory to an over-

lapping for the cure of the ventral hernia. The peritoneal cavity was opened with considerable difficulty, owing to extensive adhesions of the omentum, the transverse colon, the duodenum, and the pyloric end of the stomach. These different structures were gradually identified, as the adhesions were divided, the gastrohepatic omentum being exposed after a careful dissection of the under surface of the liver as far as the transverse fissure. There was no trace of the gall-bladder. The hepatic artery was first identified and search was made for the duct along its outer side. The hepatic end was first found embedded in adhesions and containing a large amount of bile which issued from its extremity as the adhesions were freed. At a distance of three-quarters of an inch below the end of the hepatic duct the common duct was found. It appeared collapsed but readily admitted a catheter, which was passed into the duodenum. The entire liver was jaundiced and presented the changes which develop in the course of long-standing biliary stasis. The absence of general jaundice, however, indicated that bile must have found its way into the intestine across the interval occupied by the stricture, although the exact path could not be demonstrated. On the other hand, however, the appearance of the liver indicated bile stasis, which was verified by the large accumulation of bile within the hepatic duct, which had evidently become enlarged so as to perform the function of a reservoir. Probably in cases of long-standing stricture the dilatation of the duct creates a species of tolerance for the accumulation of bile without the occurrence of actual jaundice until that obstruction shall have become complete.

The posterior edges of the divided ducts could not be approximated closely by suture, an interval of perhaps half an inch still intervening after the insertion of the catgut sutures. The point of the catheter still remaining in the duodenum, the opposite end was introduced several inches into the hepatic duct. Two ligatures of stout silk were then tied around the part of the catheter which was exposed in the interval between the divided ducts, and were brought out through the abdominal incision.

From either side of the exposed portion of the catheter the peritoneum was brought up and approximated over it by catgut sutures in several layers, so that the catheter was completely hidden from view. The abdominal wound incision was then closed by the overlapping method, a cigarette drain having previously been introduced along the margin of the silk ligatures.

For the first two or three days after the operation there was some discharge of bile from the wound. This rapidly ceased and was not renewed with the withdrawal of the drain. The bile promptly appeared in the stool in increased quantity. At the end of thirty-two days the rubber catheter was easily withdrawn under laughing gas from the duct and without any decided or prolonged discharge of bile. The wound promptly healed and the patient has been free from all discomfort for the past twenty-six months. The skin has resumed its normal color.

During this interval, however, there have been several short attacks of jaundice with epigastric pain and fever which have promptly subsided, and have interfered in no way with the general condition of the patient. September 1, 1917, patient well.

Case III.—Male, aged forty-seven years. Admitted to the Presbyterian Hospital March 14, 1917. Since 1914 patient has had from fifteen to twenty attacks of abdominal pain and distress similar to the present one. The previous attacks have been associated with jaundice, the present one not. With each attack, after a gradual onset, patient has suffered from constant boring pain in the upper right quadrant, radiating to the right shoulder and back. It has had no relation to meals and has neither been intensified nor alleviated by movement the patient has made. There has been nausea and vomiting, with once chill, fever, and malaise. The patient has lost fifteen pounds in the last two years. Between the attacks patient has had the feeling of a lump in the epigastrium. There has also been belching of gas and chronic constipation.

Physical Examination. The patient is thin and poorly nourished and nervous. There is tenderness and rigidity in the right upper quadrant in the region of the gall-bladder. The liver edge

is 5 cm. below the free costal margin. The gall-bladder is palpable. Leukocytosis, 7000, with 64 per cent. polymorphonuclears. Blood-coagulation time was three minutes. Gastric analysis showed total acidity of 75 per cent, with 25 per cent. free hydrochloric. Urine normal. Wassermann test negative. No radiographic evidence of gall-stones.

Operation. On opening the abdominal cavity through a transverse incision a large gall-stone was found in the hepatic duct, close to the transverse fissure of the liver, so tightly impacted as to require the aid of a scoop in its removal. After the removal of the stone, bile could be made to issue from the incised hepatic duct by pressure on the gall-bladder, but no bile appeared from the liver. A probe introduced upward into the hepatic duct encountered an obstruction consisting in part of calculous material. There was also marked stenosis in the lumen of the duct, on passing through which bile gushed from the upper portion of the duct.

A pair of slender forceps was then introduced through the stricture with considerable difficulty and the duct stretched so as to admit a Nélaton catheter No. 20 French. This was left *in situ* and brought out of the abdominal incision. The gall-bladder was then removed. On the ninth day after operation the catheter was removed, followed by the appearance of some bile in the stools, although the greater part passed through the biliary fistula. On the twenty-third day after operation the patient developed the symptoms of a subphrenic abscess, which was opened in two stages. By the thirtieth day after operation the discharge from the biliary fistula was slight, but still contained, as it had for the preceding two weeks, a certain amount of calculous detritus. At this time a small collection of pus in the outer angle of the abdominal incision was opened.

During the next three weeks the patient had physical signs of a bronchopneumonia, slight in character, which would disappear and then recur.

On the fifty-sixth day after operation the patient developed a marked swelling in the lower right iliac fossa. An exploration

showed the intestine matted together but no sign of pus. Twenty-four hours after this exploration, the patient developed symptoms of pulmonary edema, from which he died on the sixty-first day after operation. Unfortunately no autopsy could be obtained. At the time of his death the biliary fistula had closed and the stools were of normal color. The last exploratory incision, however, was followed by the appearance of bile (but no pus) in the dressing.

Abstracts of Cases Collected in Literature and from Personal Communication Including Bibliography

Excision of small portions of the duct wall (not complete division)

Kehr reports five accidents of this character during cholecystectomy, all of which recovered and remained permanently well with the use of a T-tube. Kehr also reports a linear defect of the hepatic duct in the course of a cholecystectomy in which a stricture subsequently developed lower down in the common duct, which he believes was also damaged during the original operation. This patient recovered.

Brewer reports a ligature of the junction of the cystic and common ducts in the course of a cholecystectomy, narrowing the lumen of the latter duct one-third. The ligature was allowed to remain *in situ* without any untoward result. The same surgeon also reports a case in which the removal of a villous growth from the interior of the common duct narrowed the duct lumen one-third. The resulting gap was closed by suture, together with the incision in the wall of the duct, without indication of subsequent stricture.

Immediate end-to-end anastomosis for repair of division or partial excision of portions of the common or hepatic ducts

1. Jacobson. Excision of a portion of the duct in cholecystectomy, leaving an interval of one inch. Above treatment. Well ten months after.

2. Körte. Suture after division of a stricture. Well one year after.

3. Körte. Excision of old stricture associated with a stone. Suture of duct ends over rubber tube, which was brought out through an opening in the hepatic duct nearer the liver. Recovery.

4. Körte. Excision of the junction of cystic and hepatic ducts owing to a short pedicle. Immediate suture. Tube removed twelfth day. Recovery.

5. Nordmann. Excision of the junction of the cystic and hepatic ducts due to "absence" of cystic duct. Immediate suture. Recurrence of jaundice in seven weeks, requiring further operation, in which the stump of the hepatic duct was anastomosed to the jejunum. Recovery.

6. Stone. Immediate suture for divided duct in course of cholecystectomy. Recovery.

7. Kehr. Excision of stricture, 1 cm. in length, two and one-half months after tear of hepatic duct. Suture. Recovery.

8. Kehr. Defect in hepatic duct closed by the Heineke-Mikulicz method. Six months after, excision of stricture. Suture. T-drain. Recovery.

9. Völcker. Immediate suture over rubber tube for excision of junction of hepatic and cystic ducts during cholecystectomy. Tube brought out through separate opening in the choledochus below point of repair. Recovery.

10. Doberauer. Interval of 4 cm. in common duct after excision of a carcinoma sutured over rubber tube which was removed eleven days after by forceps. No recurrence of jaundice. Patient died from gastric recurrence three months afterward. No autopsy.

11. Völcker. In case operated on by assistant, excision of the junction of the hepatic and cystic ducts during cholecystectomy. Similar procedure to above. Recovery.

12. Jackson. Six months after a cholecystectomy by another surgeon, patient developed persistent jaundice and epigastric pain. Operation revealed a suspicious-looking adenoma of the

common duct which was widely excised. The divided ends were sutured with some tension over a rubber tube, the point of suture being reinforced by omentum. The tube was passed on the sixteenth day. Sixteen months later the patient's condition was very satisfactory save for the occurrence of slight attacks of jaundice and epigastric pain at increasing intervals.

13. Jopson. End-to-end suture after division of the lower part of the choledochus during the excision of an extensive cancer of the pylorus. The patient was well two and a half years afterward without sign of recurrence.

14. Hotchkiss. Accidental transverse division of the common duct closed by end-to-end suture. Complete recovery.

15. Lyle. In a cholecystectomy a portion of the common duct was excised. Immediate end-to-end suture. Sutures did not hold and a persistent biliary fistula developed with abdominal pain. Six months later an operation for reconstruction of the duct was done (see Duct Reconstruction).

16. Stettin. Duct divided during cholecystectomy. Approximation of divided ends not difficult. End-to-end suture reinforced by omentum. Gradual closure of biliary fistula. Recovery.

17. Rotter. Resection of portion of the retroduodenal choledochus for benign tumors followed by end-to-end anastomosis. Drainage of duct above site of suture. Death seventh day from cholemia. Sutured duct shown by autopsy to be in satisfactory condition.

EXCISION OF STRICTURE FOLLOWING DAMAGE TO THE COMMON OR HEPATIC DUCT WITH END-TO-END ANASTOMOSIS

1. Kehr. Excision of stricture, 1 cm. in length, two and a half months after tear in hepatic duct. Suture. Recovery.

2. Kehr. Excision of junction of the hepatic and cystic ducts during cholecystectomy. Six months later, excision of stricture, release of the common duct, and bridging over interval of 1 cm. by suture.

3. Kehr. Empyema of gall-bladder. Stricture of the common duct at junction of cystic. Cholecystectomy. Excision of stricture followed by end-to-end suture. Recovery.

4. Kehr. Excision of suspicious mass at junction of hepatic and cystic ducts, leaving an interval of about two inches. End-to-end suture. Two months later, symptoms of stricture. Operation, excising stricture of 2 cm. Recovery. Well six months afterward. Mass showed no sign of cancer.

5. Völcker. Division of common duct in cholecystectomy. Twenty-four days after end-to-end anastomosis over rubber tube, which was carried down into duodenum and out through its wall by Witzel method, emerging with the drain through the abdominal incision. No leakage. Tube removed on fifth day. Recovery.

6. Kehr. Excision of old stricture. End-to-end suture supplemented by a hepato-cholangio-duodenostomy. Recovery.

7. Riggs. No previous operation. Stricture at the junction of the hepatic and cystic ducts. Resection of the stricture. End-to-end suture bridging interval of 3 cm. Temporary biliary fistula. Well four and a half years after.

CHOLECYSTENTEROSTOMY

1. Mariani. Biliary fistula, following cholecystostomy, anastomosed to pylorus. Well two years afterward.

2. Körte. Duodenocholecystostomy for apparent stricture of the papilla. Recovery.

3. Kausch. Cholecystenterostomy with enterostomosis for supposed cancer of the pancreas. Death three months later from an infectious cholangitis. Autopsy disclosed a chronic pancreatitis. There was no indication of biliary stasis. In this connection Kausch believes that the more steady flow of bile into the intestine after anastomosis between the duct and the intestine presents a greater obstacle to possible ascending infection.

4. Hotchkiss. Accidental division of the common duct near

its termination in the duodenum in connection with the removal of a pedunculated pancreatic cyst. Attempt at closure with a musculoperitoneal flap from the pylorus failed. Ultimately a cholecystenterostomy was done, first ligating with catgut the common duct on proximal side of the biliary fistula. For this purpose a Murphy button was used. Patient well one year after, although, in the meantime, he had developed diabetes.

5. Delatour. History of a cholecystostomy followed by a choledochotomy, followed by a persistent biliary fistula. At operation by Delatour the middle of the common duct which at the previous operation had been decided transversely, presented a stricture and cholecystenterostomy with Murphy button was done, the opening in the duct being closed with silk. The patient made an excellent recovery. The end-result could not be ascertained.

6. Stanton states that in several cases of simple stricture of the common duct the gall-bladder was available and that a cholecystenterostomy gave excellent results.

ANASTOMOSIS OF DUCT TO STOMACH

1. Dujarier. Anastomosis of choledochus to stomach for stenosis due to chronic pancreatitis or a benign stricture. Silk employed. Well three years afterward.

2. Kehr. Anastomosis between hepatic duct and stomach for stricture of entire choledochus. There had been no previous operation. Gall-bladder surrounded by adhesions. Recovery.

3. Brunner. A successful case of choledochogastrostomy. No detail.

4. O'Day. Patient gave a history of repeated attacks of colic, the jaundice subsequently becoming persistent. On operation a fistulous tract was found, leading from the perforated duct to the lesser peritoneal cavity which was shut off from the greater cavity by obliteration of the foramen of Winslow. In the lesser cavity was found a considerable amount of bile containing one calculus. During an attempt to free the choledochus

it broke off at a point just above the adherent mass in which the termination of the duct was embedded and abundant bile exuded from the proximal end. An anastomosis was done between this stump and the anterior wall of the stomach in its lower one-third. The gall-bladder was obliterated and was not disturbed. Recovery.

Six years after the patient was in excellent condition without indication of any disturbance of digestion.

5. Quenu and Tuffier. The operators report a case of anastomosis between the hepatic duct and the stomach. No detail.

6. Kehr (referred to by Kausch). Cholecystectomy followed by persistent biliary fistula. Anastomosis between the pylorus and the stump of the cystic duct followed by both biliary and gastric fistulæ, the last closing only after an interval of eleven years.

ANASTOMOSIS OF DUCT TO DUODENUM

1. Bazy (discussion of case of Dujarier). Hepaticoduodenostomy for probable stricture of the papilla. Patient well four years afterward.

2. Mann. Two years after cholecystectomy anastomosis between the end of the hepatic duct and duodenum, the wall of which was infolded around the tube. The lower part of the common duct was apparently obliterated. Fate of tube uncertain. Recovery. Patient well three and three-fourth years afterward. Occasional attacks of jaundice and epigastric pain at increasing intervals.

3. Kehr. Immediate hepatoduodenostomy after accidental excision of 6 cm. of hepatic and common ducts during cholecystectomy. Through a second incision in the duodenum the end of the duct was sutured to its lining mucous membrane. Kehr prefers this procedure to anastomosis with tube as advocated by Wilms.

4. Terrier. After failure to reconstruct with omentum, hepatoduodenostomy was successfully done. Recovery. No detail.

5. Terrier. Hepatoduodenostomy for a chronic enlargement of the pancreas. No detail.

6. Losser (reported by Völcker). Hepaticoduodenostomy for a stricture of the choledochus following cholecystectomy, the tube being brought out through a second opening in the duodenum and emerging from the abdomen with the tampon. Recovery complicated with a duodenal fistula which it is believed was the result of the tearing of the sutures on the withdrawal of the tampon. This fistula closed spontaneously in three weeks.

7. Terrier. Hepaticoduodenostomy after a stricture of the common duct following a series of operations, namely, cholecystostomy, cholecystectomy and then plastic operation on the common duct. Recovery. No data.

8. Kehr. Choledochoduodenostomy for stricture following cholecystectomy (with same detail as in 3). Stenosis developed requiring a second similar operation from which the patient died three days after. No autopsy.

9. McGlannan. Persistent biliary fistula after cholecystectomy due to stricture of choledochus near head of pancreas. Direct anastomosis over rubber tube with duodenum. Both biliary and duodenal fistulæ developed and patient died. No autopsy.

10. Bottomley. For three years attacks of pain in the upper right quadrant, with vomiting and jaundice which persisted up to five months ago and then gradually faded away. Chills and sweating with recent attacks. Exploration through a Bevan incision found a gall-bladder containing a moderate amount of pus and two stones. The common duct, dilated above a stricture, contained abundant bile mixed with pus. Through an opening in the duodenum the ampulla could not be found. Catheter introduced into the dilated duct above and the duodenal orifice below and the remains of the duct sutured over it and the duodenum over all. Cholecystectomy. Recovery without leakage. Tube passed in nine days.

Well for twenty-one months. Then two attacks of slight

jaundice with chilly sensations and some epigastric pain of short duration.

11. Summers. No prior operation. Choledochoduodenostomy with Murphy button for stricture of the end of the duct. Operation supplemented by cholecystostomy. Button was never recovered. Well seven years after.

12. Crile. After prior cholecystectomy a complete stricture developed in the common duct from the point of drainage to the ampulla. Excision of stricture. Opening in the outer margin of the duodenum after mobilizing. Stump of duct drawn down through opening made from within in the location of the papilla and sutured both on the outer and inner aspect of the intestine. Patient well three years afterward.

13. Wilms. No previous operation. Stones removed disclosing stricture of the lower part of the common duct with an indurated pancreas. Anastomosis of the divided end of the choledochus over a rubber tube with the duodenum. Attempt to remove the tube by traction on a loop of silk passed with the tube into the duodenum and out through an opening lower down to emerge with the drain failed. X-ray showed no tube two and a half weeks after operation. Patient well fifteen months afterward.

14. Gosset (referred to by Kausch). Packard is said by Gosset to have implanted the choledochus in a new duodenal opening for stricture due to a callus ulcer of the ampulla.

15. Tedenay. Resection of adenoma of the common duct followed by choledochoduodenostomy. No mention of end-result.

16. McArthur. This writer mentions in discussion a patient who after previous cholecystostomy and cholecystectomy in another clinic had a third unsuccessful operation for the repair of a stricture of the duct (abandoned on account of the hemorrhage). The patient came under his observation with a persistent biliary fistula which occasionally closed and brought on jaundice. On operation by McArthur the fistula led to the proximal stump of a previously divided duct about the middle

of the original common duct. The distal portion of the duct was not recognizable. There was moderate biliary cirrhosis.

An anastomosis was done between the proximal stump and the duodenum, over a rubber tube eight inches long in which the proximal end supplied with a flange was inserted in the hepatic duct, the remainder being allowed to protrude into the duodenum, to favor its subsequent passage, which occurred eight weeks after. The flange insured a large opening being left in the duodenum. The patient died two years later from carcinoma of the stomach. (Operation in 1908.)

17. McArthur. This patient had had cholecystostomy and later drainage of the common duct for persistent jaundice (by another surgeon). On operation by McArthur a stricture was found in the common duct between the point of drainage and the bowel. An anastomosis between the duct above the point of stricture and the duodenum was done in the same way as in the preceding case. The patient was well two years after the operation and since then could not be traced. (Operation, 1912.)

ANASTOMOSIS OF DUCT WITH JEJUNUM

1. Nordmann. After unsuccessful anastomosis of ends of divided duct (see Anastomosis of Duct), anastomosis between hepatic stump and jejunum, with loop excluded by simple entero-anastomosis through a Witzel opening. The tube was brought out of the jejunum through a second opening (Witzel) lower down, and emerged from the abdomen with the drain. Point of entrance of the tube into jejunum strengthened by omentum. Recovery.

2. Jackson. Removal of cancer of pylorus which, in view of possible stricture of the common duct, was supplemented by choledochotomy. At a later operation anastomosis between the hepatic stump and a jejunal loop brought up in front of the transverse colon was done over a rubber tube, the common duct having developed an impassable stricture for a distance of sev-

eral inches. The jejunal loop was sutured to both liver and pancreas and was infolded over the tube as it passed through its wall. Patient made an excellent recovery but died from a sudden gastric hemorrhage eleven months afterward. No autopsy.

3. Kausch. Anastomosis between choledochus and the narrowed end of a divided loop of excluded small intestine. Well one year after.

4. Dahl. Modified proceeding of Kausch in that the divided end of the excluded loop was brought up through the transverse mesocolon and sutured to the gastrohepatic omentum, the hepatic duct being then anastomosed to its narrowed orifice. Recovery with a temporary fistula.

5. Bakes. Choledochus was divided in the course of a Billroth operation for cancer of the pylorus. The divided end was brought through a small opening in the jejunum and fastened to the opposite wall by suture. Death from pancreatic necrosis. Duct in excellent condition.

6. Enderlen (referred to by Kausch). Cholecystostomy and then cholecystectomy. Subsequent stricture. Jejunum anastomosed to the stump of the hepatic duct after being sutured to the thickened liver capsule. Death ten days later from hemorrhage due to a needle puncture of the hepatic artery.

ANASTOMOSIS OF A BILIARY FISTULA WITH DUODENUM

Von Stubenrauch. Anastomosis of a biliary fistula after its dissection from surrounding tissues with duodenum. The fistulous tract necrosed and subsequently an operation was done in which a new duct was successfully supplied by a plastic method.

ANASTOMOSIS OF BILIARY FISTULA WITH DISTAL END OF THE COMMON DUCT

Murphy. Female, aged forty-six years. History of three operations for gall-stone difficulty in the last two years. On

admission there were two biliary fistulæ and one fecal fistula in the upper right quadrant together with numerous scars and a ventral hernia. On operation no trace of the gall-bladder could be found. The fistula leading into the large bowel was excised and closed. The double biliary fistula joined at some little distance from the abdominal wall and the channel thus formed ran parallel and adjacent to the common duct. At a point relatively free from adhesions, the biliary fistula was divided and its end telescoped into the distal portion of the common duct. Dr. Murphy continues. "The patient left the hospital four weeks after operation. There was still some bile in the urine but there was also bile in the stool. Both biliary and fecal fistulæ were completely closed. Two months after her discharge the patient was attending to her household duties. She was not yellow. There were two sinuses discharging creamy pus in the right side, suggesting the possibility of a foreign body. She declined to enter the hospital. Two months later she complained of pain in the right upper quadrant. The sinuses had closed but there was still a large ventral hernia. The skin showed a slight lemon tinge. There was no bile in the urine and there was bile in the stools. She left the hospital against advice and later was said to have died from a recurrence of the jaundice. This reconstructed common duct certainly functioned for about six months."

RECONSTRUCTION WITH VISCERAL FLAP

1. Walton. Choledochotomy for pancreatic obstruction. Three weeks later a tube was passed from the end of the common duct into the orifice of the duodenum, resulting from the raising of a pedunculated flap consisting of all of its layers and which was turned upward in such a way as to completely encircle the exposed portion of the tube. The duodenal opening was closed up to the tube. Recovery. No leakage. Ultimate result not stated.

2. Kehr. Cholecystostomy by another surgeon, the jaundice

persisting. Kehr found an atrophic gall-bladder with stricture in the supraduodenal part of the duct which was excised for a distance of 3 cm. The posterior edges of the divided duct were approximated and the defect anteriorly was covered by a pedunculated flap from the gall-bladder with the mucous membrane turned toward the duct lining. Hepatic drain removed the tenth day. Recovery. Six months after excellent health.

3. Kehr. A defect in the anterior wall of the common duct, after the removal of calculi was successfully closed by using the stump of the cystic duct after a cholecystectomy. Recovery.

4. Kehr. Gap in common duct after a cholecystectomy, closed by pedunculated flap from the stomach consisting of the peritoneum and the muscle wall, the latter forming the new lining of the duct. Death from pneumonia on tenth day. No leakage. Flap in excellent condition.

5. Von Stubenrauch. After failure of using biliary fistula tract for anastomosis with duodenum, a new duct was formed by turning upward a duodenopyloric flap of entire thickness.

6. Ginsburg and Speese. Common duct divided in a cholecystectomy (the cystic and hepatic ducts being parallel). Nine days later ends of divided duct exposed and a T-tube inserted. The horizontal part of the tube was enveloped in a flap taken from the posterior sheath of the rectus muscle and sutured like a cuff around the ends of the duct and also to wall on duodenum, the center of the transplant being perforated for the exit of the tube. After one week a biliary fistula formed and two and a half months after a second operation, showing displacement of tube but a flap apparently viable. A third operation, done for persistent pain, was followed by a temporary biliary fistula. The reconstructed duct was in satisfactory condition.

DUCT RECONSTRUCTION

1. Verhoogen. At primary operation there was found a suspicious mass at the junction of the hepatic, cystic and common

ducts which was excised together with the gall-bladder. After the removal of a stone from the lower choledochus, the ends of the divided duct were separated by an interval of 6 cm. A rubber catheter was passed through into the duodenum and passed upward so as to lie in contact with the end of the hepatic duct. It was here bent at a right angle and brought out of the wound with the tampon. The tube was removed on the twelfth day after operation. The patient was well eleven months afterward, having had one attack of colic with jaundice two months after the operation.

2. Propping. Stricture after a previous cholecystectomy, in the center of the gastrohepatic omentum, resected, leaving an interval of 4 cm. T-tube introduced above and below and the wound tamponed. Tube removed in three weeks. Biliary fistula completely closed in a few days. Patent did not long remain free from symptoms of recurrence, developing jaundice several weeks after the closure of the fistula. Two and one-half years later, on operation, the site of the previous stricture presented a duct normal in appearance with mucous membrane apparently lined with epithelium. The stricture was now situated close to the transverse fissure of the liver in the hepatic duct. This was also treated by the insertion of a T-tube. No note of end-result.

3. Kehr. Hepatic duct divided in cholecystectomy. Collapse of the patient necessitated immediate cessation of the operation without attempt at reconstruction or end-to-end suture. One month after tube inserted, projecting two inches into the hepatic duct above and the common duct below. Tampon. The tube was removed four weeks later by traction on silk ligatures which had been passed around it. No mention of end-result.

4. Freeman. Previous cholecystectomy for atrophied gall-bladder entirely buried in the substance of the liver. Subsequently, occlusion of the duct was indicated by marked jaundice, clay-colored stools and by periodical chills and fever which, at

the autopsy, eleven months after the operation for the strictured duct, proved to be due to an old, thick-walled abscess of the liver. At the operation for stricture firm and extensive adhesions were encountered and the duct was exposed with difficulty. At the point where the common duct entered the liver and opposite the former site of the gall-bladder, a cicatricial stricture was found due to the involvement of the duct in the cicatrix which had replaced the gall-bladder. The stricture was split and along the gutter of the duct a tube was passed up into the unstrictured part of the duct within the liver. The other extremity of the tube left the duct at the lower end of the stricture and was brought out of the abdominal wound with the drain. The tube occupying the divided duct was covered in this situation with peritoneum. During the eleven months that the patient survived, the duct functioned well, the stools being continually colored with bile. At the autopsy the appearance of the abscess of the liver from which the patient died indicated that it had been in existence some time prior to the operation for the strictured duct. The duct itself was found patulous although small. It was about the size of a broom-straw but fluid could readily be injected through it. There was also found an old duodenal ulcer which had perforated adjacent liver tissue to which it had become adherent.

5. McRae. Cites a case of stricture of the common duct which was treated by incision, dilatation and drainage. The patient was in excellent condition two and a half years after the operation.

6. Finney. After previous operations by other surgeons a biliary fistula remained. Operation then disclosed a complete obliteration about the center of the choledochus which was excised, leaving an interval of an inch. As approximation was impossible, a rubber tube was inserted into the hepatic and into the common duct below but could not be brought through into the duodenum. The omentum and adjacent peritoneal structures were carefully sutured about the exposed part of the tube which

was accordingly left free in the duct and was never removed or, so far as observed, passed. The patient is well two years afterward, having had one slight attack of jaundice and abdominal pain one year ago.

7. Stewart. Previous cholecystostomy by another surgeon. Cholecystectomy by self. Subsequent stricture about one-third of an inch in length developed in the common duct just below its junction with the cystic. The stricture was divided and a rubber tube passed from the hepatic above through the common below into the duodenum and was covered by omentum. Death occurred on the fourth day from hemorrhage, the source of which could not be determined at the autopsy. The adhesions in this case were extensive and the liver was cirrhotic.

8. Völcker. Defect of from $1\frac{1}{2}$ to 2 cm. after a cholecystectomy, bridged by tube which was covered in by omentum and liver, the tube being left *in situ*. Biliary fistula persisted. Four months later, exploration showed an interval of 2 cm. between the ends of the duct forming a right angle with the tube impacted in the common duct. This was removed and a catheter inserted, was passed through into the duodenum and brought out through a "Witzel" opening emerging from the abdomen with the drain. The tube was removed on the fourth day. Recovery.

(8*a*.) Lyle. Six months after an unsuccessful suture of the divided ends of the common duct in the course of a cholecystectomy, operation revealed a stricture between one-half and three-quarters of an inch in length, surrounded by numerous adhesions, which was excised. The posterior edges were approximated by suture. As the anterior edges could not be sutured a rubber catheter was passed up into the hepatic duct and down through the common duct into the duodenum. The exposed part of the catheter was covered with the round ligament and omentum. The catheter was passed on the thirteenth day.

The patient remained well for two and a half years and then began to complain of attacks of pain. Lyle states that she was

operated on by another surgeon in October, 1916, who found a stricture of the common duct with biliary calculi on its proximal side. In January, 1917, Lyle examined her and at that time she seemed to be developing a recurrence of the calculi.

9. Brewer. Rubber tube between hepatic stump and duodenum, enveloped by omentum. Good function. Recurrence in about a month with jaundice and signs of infection which disappeared but shortly returned, the patient succumbing to an operation for its relief.

10. Terrier. This author mentions a case of reconstruction of the common duct with omentum, which failed, and was followed by a successful hepatoduodenostomy.

11. Sullivan, Arthur G. "Four years ago I inserted a rubber tube in a man of about sixty years, who had been operated on at a large clinic for common duct stone. A few months after his first operation he came under my care as an emergency condition with symptoms indicating a duodenal perforation. On operation the common duct was found to have been perforated by the pressure of two large calculi. All the tissues were intensely inflamed and the duct had a large rent in it. Drainage. Some time later when evidence of stenosis had appeared an operation revealed so much thick, dense fibrous tissue in the duct at the point of former perforation that reconstruction with a rubber tube was necessary. The stricture was at least $1\frac{1}{2}$ inches in length. His convalescence was rapid and shortly after he again performed the duties of an engineer, and has continued in excellent health since the operation."

12. Jenckel. Cholecystectomy. Four weeks later, increasing jaundice notwithstanding the presence of a biliary fistula. Operation five months later showed complete obliteration of the entire choledochus. Tube sewn into the right hepatic duct and passed into the duodenum below through a "Witzel" opening bridged an interval of 8 cm. Tampon. Three weeks later duodenal fistula developed which gradually closed. For a time patient had occasional attacks of colic and chills which ceased

and now, four years after the operation, patient is completely well.

13. Propping. Cholecystectomy (lesion of the gall-bladder associated with edema of the gastrohepatic omentum). Five and one-half months later stricture was found involving the entire choledochus. Tube, extending from hepatic above through "Witzel" duodenum below, bridged interval of 6 cm. Death twelve days later from recurrent cholemic hemorrhage. Autopsy, tube in satisfactory position.

14. Wilms. Three and a half weeks after excision of the junction of the cystic and hepatic ducts, together with the adjacent glands, the resulting interval was bridged with a rubber tube passing below into the jejunum, being anchored in its course by catgut sutures to the parietal peritoneum. Slight discharge from biliary fistula and slight colicky pains in right hypochondrium on sitting.

15. Wilms. Cholecystectomy. Recurrence of colic with closure of fistula. At second operation tube was passed from the hepatic above into the duodenum below. Convalescence complicated by duodenal fistula, requiring a jejunostomy to secure its closure. Eleven days after catheter discharged through the wound. Thirty-eight days after operation tube removed from jejunostomy. Patient well fifteen months after operaton with slight biliary fistula.

16. Wilms. Choledochus found impassable after choledochotomy. Tube from hepatic into duodenum. Functionating of the tube seemed to be proved by the vomiting, postoperative, of a large amount of bile. Recurrence of biliary fistula. Twenty days after first operation, exploration showed tube to be out of the hepaticus. It was then sewn in. Two months after the operation the patient vomited the tube.

17. Wilms. Cholecystectomy. Six days later, end-to-end suture of the ends of the divided duct over a tube. A persistent biliary fistula formed which, four and a half months later, on exploration, was found to have been the result of the angulation

of the tube with a separation of the duct ends for a distance of 2 cm. The "Völcker" transduodenal operation was then done, but the jaundice persisting, a "Wilms" operation was done after an interval of seven months. Three months later, after the vomiting of the tube the symptoms recurred and the operation was repeated. In this last operation, the tube was passed from the hepatic duct into the stomach. Recovery. Wilms advocates the ligation of a loop of silk around the upper end of the tube, the passing of the silk along the tube into the duodenum, the perforation of the duodenum by the silk lower down and its emerging with the drain from the abdomen. By traction on the silk the passage of the tube into the duodenum is supposed to be facilitated.

The preceding cases, gathered from the literature and contributed through the kindness of my colleagues, are of great interest, especially in view of the end-results achieved. To draw any conclusions of value, however, regarding the comparative merits of different types of operations and their mortality from cases collected from the literature is most deceptive, for a large number of failures to relieve as well as actual fatalities are never published. For these reasons the statistics of the Mayo Clinic, for which I am greatly indebted to Dr. W. J. Mayo and his colleague, are herewith given separately as, obviously, to regroup the 45 cases with others of their type would detract materially from their interest and value.

REVIEW OF 45 OPERATIONS FOR RECONSTRUCTION OF BILE DUCTS ON ACCOUNT OF BENIGN STRICTURE

Number of cases, female	26
Number of cases, male	12
Total	38

DECADES

20 to 30 years	5
30 to 40 years	8
40 to 50 years	10
50 to 60 years	13
60 to 70 years	2

CHIEF COMPLAINT

Colic	28
Jaundice	29
Complete biliary fistula	11

PREVIOUS OPERATIONS ON BILIARY SYSTEM

Cholecystectomy elsewhere	15
here	11
Total	26
Cholecystostomy elsewhere	5
here	1
Total	6
Choledochotomy elsewhere	1
here	4
Total	5
Cases had no previous operations	18

PRESENT OPERATIVE FINDINGS

In hepatic	5
Benign stricture of bile ducts	45
" " in common	9
Segmental excision of duct	13
Junction of cystic and hepatic	31
Inflammation as result of stones	32

TYPE OF OPERATIONS

End-to-end anastomosis or plastic reconstruction of hepatic duct, common duct, or hepatic to common	31
Anastomosis of hepatic duct to duodenum (hepaticoduodenostomy)	12
Anastomosis of hepatic duct to stomach (hepaticogastrostomy)	2

TYPE OF ANASTOMOSIS

With a tube (Sullivan or "T")	28
No tube	17
Hospital mortality	11.1 per cent.

RESULTS

Cases heard from	23
Cases died since operation	3
Cases living yet	20

Nine cases had attacks of colic since operation (no colic, 14).
Eleven cases had jaundice since operation (no jaundice, 12).
Twenty-three cases had no bile drain from wound since operation.
Nineteen cases had bile-colored stools continuously (slight clay-colored, 4).
Nineteen cases with wound O. K. since operation (slight tenderness, 4).
No hernia or bulging of the wound in any case.

CASES HAVING JAUNDICE

Continuous deep jaundice, 2. One of these died in a few months.
Deep jaundice by attacks, 3.
Only slight jaundice occasionally, 6.
Of 20 living 19 are reasonably well and able to work.
One almost completely incapacitated on account of attacks of colic and jaundice.
One case quite well—sailed recently for Petrograd.
Two cases have borne children since.

OF THE THREE CASES THAT DIED

One was reported to have died from carcinoma of the pancreas.
One did not do well and died of some septic condition.
One had continuous jaundice and died within a few months following operation.

RESULTS OF DIFFERENT TYPES OF OPERATION

End-to-end or plastic reconstruction, 31 operations. Of these 8 heard from, of which 1 died, 3 were having attacks of colic, and 4 were quite well.
Hepaticoduodenostomy, 12 operations, of which 6 were heard from. Of these 2 died since operation, 1 has slight continuous jaundice, and 3 were quite well.
Hepaticogastrostomy, 2 operations; both living and well. One has slight jaundice occasionally.

HEPATOSTOMY (CHOLANGIOSTOMY)

1. Tiegel (mentioned by Scheidler). This operator refers to a case of severe cholemia, in which Tiegel established a biliary fistula by opening the liver through the gall-bladder, terminating the operation as in cholecystostomy. The patient recovered from the operation but later died from exhaustion. Scheidler believes that this might have been prevented, had the operation been supplemented by an anastomosis between the gall-bladder and intestine, and cites the unfavorable outcome as an argument against doing a hepato-enterostomy in two stages.

2. Jenckel. Female, aged seventeen years. History of attack of jaundice when six years old. On admission intense jaundice without colic. On operation, the gall-bladder was atrophic and empty. There was no dilatation of either hepatic or common duct. Cause of jaundice could not be determined. It was possibly parasitic. To relieve it the liver was penetrated with the cautery after being stitched into the incision. No bile, however, flowed. The fistula promptly closed and the patient recovered. Shortly after discharge from hospital the jaundice disappeared and the patient remained free from recurrence, being well six years after the operation.

3. Cohen. Hepatostomy one week after a cholecystectomy for persistent jaundice, the hepatic and common ducts being inaccessible on account of adhesions and fear of hemorrhage. After forty-eight hours the biliary fistula discharged copiously. After twenty days bile again passed into the intestine and stones were discharged from the biliary (gall-bladder) fistula, which eventually closed.

4. Lohse. Hepatostomy for cancer at the transverse fissure through the gall-bladder which contained no bile. On seventeenth day stools again became colored. Death occurred two and one-half months after operation and several weeks after the complete closure of the fistula.

5. Kausch. Hepatostomy for obstruction due to a chronic pancreatitis, patient living six weeks. During this time a

curettage of the liver surface was necessary to secure a flow of bile on several occasions.

6. Kausch. Hepatostomy for congenital atresia of the duct, the patient dying on the fourth day from peritonitis.

HEPATO-ENTEROSTOMY

1. Lameris. Excision of carcinoma of the common duct. Biliary fistula. Excision of a recurrence near the transverse fissure several months later, leaving only a small part of the hepatic duct above and the common duct below. The jejunum about 40 cm. below the duodenojejunal angle was sutured to a defect made by the cautery in the right lobe of the liver. No jaundice. Biliary fistula closed and patient returned to work. Death eight months later from multiple liver abscess. On autopsy the mouths of ten openings could be demonstrated in the mucous membrane of the jejunal loop, which were lined with cylindrical epithelium, from which bile could be exuded by pressure.

2. Scheidler. Female, aged twenty-eight years. History of cholelithiasis for eleven years. For six years complete jaundice with rapid loss of strength and such severe pain as to require constant morphin. On operation the duct was inaccessible owing to extensive adhesions and a marked swelling of the pancreas. The gall-bladder was distended with inflammatory exudate but contained no bile. Liver was opened with the cautery through the gall-bladder supplemented by a cholecystenterostomy with a Murphy button, a loop of jejunum being used, previously excluded by enteranastomosis. The patient recovered and was well and pregnant five months afterward

3. Kehr. Reports a case of hepato-cholangio-duodenostomy, supplementing an end-to-end anastomosis of the common duct after excision of a stricture.

4. Doberer. In effort to anastomose duodenum and hepatic duct for a stricture following choledochotomy, the liver tore at

the transverse fissure and the adjacent duodenum also gave way. The two orifices were then approximated by suture. The patient recovered with a small temporary duodenal fistula.

5. Kehr (referred to by Kaüsch). Hepatoduodenostomy for obstruction in accessible portion of the common duct. Recovery. Jaundice decreased. Patient died eight weeks later. No autopsy.

6, 7, 8. Kehr. In these three cases a hepato-enterostomy was done for carcinoma of the pancreas. Two died promptly of hemorrhage. The third died on the seventeenth day and autopsy showed bile in the intestine.

9. Czerny. In 1899 hepato-enterostomy for obstruction in inaccessible portion of the duct, the patient dying of peritonitis.

10, 11. Kaüsch. Two cases of hepato-enterostomy for carcinoma, of which one died on the fourth day, the bile being collected in a small sac outside of both liver and intestine, the latter dying on the eighth day from peritonitis. Both cases were carcinoma.

12. Maylard. Hepatojejunostomy on liver border for benign stenosis. No improvement after one month. Death two months after operation. No autopsy.

13. Ehrhardt. Hepatojejunostomy for congenital defect of common duct in a child of six months. Stools contained bile in twenty-four hours. Death on sixth day from enteritis. Autopsy showed no peritonitis and sutures held.

14. Lejars. Cholecystectomy. Later, drainage of the hepatic duct for stricture. Later on a hepatoduodenostomy on account of obstruction due to general adhesions. Death. No autopsy.

15. Garré. Traumatic rupture of the common duct which was drained and subsequently followed by both biliary and fecal fistulæ. Six months after accident jaundice developed. Three months later or nine months after the accident a hepatoduodenostomy was done, using the left lobe of the liver. Six days after operation the stools contained bile. The patient made a complete recovery and was perfectly well three years afterward. (Some believe that in this case the bile subsequently found its

way into the intestine through some other channel than by the liver-duodenal fistula.)

I wish to express my sincere thanks and my deep sense of personal obligation to all those who have so kindly coöperated in the preparation of this paper.

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DISCUSSION

Dr. William J. Mayo, Rochester, Minn.:

Conditions which necessitate reconstruction of the common and hepatic ducts for the purpose of securing a channel for the free flow of bile between the liver and the intestine divide themselves rather naturally into two groups:

1. Cases in which the duct is accidentally injured and the injury is discovered, the repair being made as a primary operation, or cases in which the duct is resected for tumor.

2. Cases in which, following an injury, the loss of continuity of the duct is not discovered until a biliary fistula or other manifestation of obstruction is disclosed. When the common duct has been accidentally injured and the injury is immediately recognized, I have found it easy to repair, by direct suture, a gap of one inch, reconstructing either over a T-tube or in some cases by direct union, when the duct was too small to use a tube. In every one of these cases the wound healed promptly, and so far as I know the patients have remained well.

Our experience in resections of the common duct for cancer have been distinctly unsatisfactory. The immediate mortality was high. Two patients died as the result of the operation, and none of those who recovered lived more than two years. At the same time, carcinoma of the duct, in an early stage, should be operable. The lesion is usually a hard, grayish-white tumor of slow growth, not more than 2 cm. in length by 1 cm. in diameter, metastasizing late. By improving the technic I am hoping to be able to cure some of these patients.

When we come to the late group, with fistula, jaundice, and marked evidences of malnutrition, the prospects of repair are by no means so favorable. First, is the tendency to hemorrhage. When obstruction of the duct causes jaundice, the bile acids circulating in the blood combine with the calcium bases, and, if the obstruction is complete, the calcium reserve will be exhausted in about three weeks. Upon the calcium in the blood depends permanent clotting. The blood platelet reserve is also exhausted. Jaundice is the only one of the dyscrasias associated with hemorrhagic disorders in which the giving of calcium has been shown to be of value. It must be given in doses of at least 1 or 2 drams every twenty-four hours. If there is much gastric disturbance, it should be given in solution per rectum.

When the blood-coagulation time is above fifteen minutes (normal five minutes), serious trouble may be looked for and restoration of the blood calcium reserve is not sufficient. However, if blood is transfused from a proper donor twenty-four hours before the operation, the coagulation time can be temporarily brought down close to normal and the patient may be operated on with much greater safety. It

may be necessary to repeat the transfusion about the fourth day after the operation; the calcium should also be continued after the operation.

In these secondary operations we have found Harris' suggestion valuable; that is, exposing the common duct by a high abdominal incision through the gastrohepatic omentum. This prevents extensive separation of adhesions and the great tendency to cause bleeding and injury to the stomach, duodenum and colon. In suitable cases we implant the hepatic duct into the duodenum and have found it one of the best operations. Coming down from above relieves the necessity for separation of the duodenum, which will almost always be found adhered to the injured part, and it will not be necessary to bring the duodenum up for the purpose of anastomosis. The opening in the duodenum should be a half-circle with its base behind; this gives a little flap for muco-mucous union with the hepatic duct. By the use of the Sullivan tube the flap may be united by a catgut suture to the part of the tube which is to be projected into the hepatic duct; thus when the tube is introduced it carries the flap with it; greatly aiding the restoration of the posterior wall. We have used only chromic catgut for sutures and have sutured the duodenum well up against the liver, covering the anastomosed area with the separated adhesions, scraps of separated fat and the omenta. A little piece of rubber tissue above and below the anastomosis is introduced for temporary drainage. Union has not failed to occur. In a few of our cases there has been more or less recurrence of symptoms, due either to narrowing from failure of sufficient muco-mucous union or to secondary infections, but, generally speaking, the results have been satisfactory.

Dr. Leonard Freeman, Denver:

It seems to me that Dr. Eliot has given us the best exposition of the subject of which I know, and his division into different headings of the methods of correction of strictures, is certainly very illuminating. It occurs to me, however, that he has left out one possible method—the one I followed in the case he mentioned. That is, the method of *not* dissecting out the cicatricial tissue, which he advocated in every case, but simply slitting up the stricture of the duct and letting it widen out, and then covering the gutter thus formed with peritoneum from the sides. It would appear to me that this has some advantage, in that if we are to get the new duct so that it will not contract it must be lined with epithelium and this epithelium would have to come very largely from the old cicatricial portion of the duct. In slitting up the duct, as in my case, it was possible to detect this epithelium, although the lumen of the duct had almost entirely, and in some places apparently entirely, vanished.

Dr. Walton Martin, New York City:

I wish simply to put on record an instance of spontaneous reconstruction of the duct after excision. The case is as follows: There was a carcinoma of the gall-bladder extending into the common duct. The gall-bladder was removed and the common duct to the extent of one inch. Believing that the case was hopeless from the point of view of ultimate recovery, the duct was then simply drained, no attempt whatever being made to make any reconstruction, the idea being to establish a permanent biliary fistula. The patient made a satisfactory recovery and went on with a fistula for some months then the fistula closed spontaneously and remained closed until the patient's death from carcinoma of the liver about six months later.

Dr. Wallace I. Terry, San Francisco:

I have met one type of complete absence of the common duct following gall-stone disease, in which I reconstructed it by means of the duodenum attached to the hepatic duct. In that case I could not bring the duodenum entirely up. I did not mobilize it sufficiently—it was done some ten years ago—but I utilized the base of the liver for the anterior wall of the duct. It worked satisfactorily and the woman is well today. In a later case I sutured the common duct, as Dr. Eliot has illustrated, but over a catheter with the flared end in the duodenum. It was sutured in place in the papilla, and the tube came away in the course of three weeks and a permanent duct was secured. In regard to hepatostomy, I have had occasion to do two for inoperable carcinomas of the duct, with great distention of the intrahepatic ducts. I utilized the gall-bladder in those cases. The gall-bladder was opened at the fundus and then an incision was made through the gall-bladder posteriorly into the intrahepatic ducts. The gall-bladder was then sutured to the opened duodenum. In that case the woman was relieved from jaundice until death took place from carcinoma.

Dr. Alexis V. Moschcowitz, New York City:

Without wishing to be facetious I would divide these cases into two groups: (1) those cases in which the excision or the stricture is following somebody else's work, and (2) those in which it has followed your own work. I believe the first group, namely, those in which the fistula has followed somebody else's work, is far more interesting than the second group, or those which have followed one's own work. I dread to see the cases which follow my own original operations, but such has been my misfortune in 3 cases. Nature is, however, very kindly toward the surgeon, for whereas the point of division appears to be at an enormous depth at the primary operation, the entire field appears to have come to the surface at the second operation. There seems to be an attempt on the part of nature to approximate the two

ends; even what appears to be an unbridgable hiatus at the first operation, proves at the second to be really much less difficult of closure.

Dr. Ellsworth Eliot, Jr., New York City (in closing):

In regard to the Heineke-Mikulicz operation for these strictures, it may be of interest to note that two instances of this operation with subsequent recurrence are reported in the literature. To me the method appears less satisfactory than resection with end-to-end anastomosis. In regard to mobilizing the duodenum Dr. Mayo has stated that in many instances this has already been accomplished by the contraction of adhesions. In a case of this character reported by Cohen in the exposure of the stricture both the duodenum and the contiguous surface of the liver were accidentally ruptured, permitting a hepato-enterostomy. In many other cases no contraction of adhesion has taken place and mobilizing of the duodenum has facilitated either the approximation of the end of the hepatic stump to the duodenum or an end-to-end anastomosis of the divided ends of the duct. In regard to the opening in the duodenum, the dangers of ascending infection with abscess of the liver or of regurgitation of the intestinal contents into the anastomosed duct are materially lessened, if the opening is made obliquely, after the manner of Witzel. I am afraid my mention of Dr. Freeman's case was incomplete; a full and complete account of it, however, will appear in my paper. It was covered in a measure by the first method of treatment mentioned, namely, the linear division of the stricture practised by myself in 1907, and followed by a reëstablishment of the biliary channel of at least one year's duration. I stated that Dr. Summer's end-result was of seven years' duration: I recall very distinctly in looking up his reference that it was reported in 1906, and that therefore it was one of the very earliest cases recorded. Dr. Terry also referred to the fact of doing hepato-enterostomy through the gall-bladder, and this seems to be the operation of choice where a normal gall-bladder is found—which is rarely the case if the condition is of long standing. I am sorry Dr. McArthur is not here, and I want briefly to refer to the method not hitherto mentioned in the discussion, which he utilizes to ensure the ultimate discharge, per rectum, of the tube used in connection with the anastomosis. It is the simple expedient of allowing the terminal end of the tube to project eight to ten inches into the duodenum, into which cavity it is eventually discharged through peristaltic activity; in a reported case it was so discharged at the end of eighteen days. Dr. McArthur also has called attention to the fact that the end of the tube lying within the duct has a cuff upon it which as the tube passes down into the duodenum still further dilates the opening in the duodenal wall and so ensures its ultimate permeability.

BILE PERITONITIS WITHOUT EVIDENT PERFORATION OF THE BILIARY TRACT

By J. J. BUCHANAN, M.D.
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Effusion of bile into the peritoneal cavity without evident rupture or perforation of the bile tract or alimentary canal has received serious consideration only within the last seven years.

In a few previously recorded cases massive bile effusions have been found at autopsy when no evident lesion could be discovered. In all such cases, however, the clinical history pointed to a rupture, and the parts were in such a pathological state that such a lesion could not be positively denied.

A typical case of this kind occurred August 11, 1783, when a fourteen-year-old boy fell from a mulberry tree, striking the ground with his belly. At noon on the same day he was admitted to Guy's Hospital, London, under the care of Doctor Saunders, who bled him frequently (three times in the first twenty-four hours), purged him constantly, and blistered his abdomen.

Notwithstanding this treatment, the boy was able to be up walking about the ward on the fifth day. His abdomen, however, began to enlarge, and his general condition became progressively worse until the twenty-fourth day, when he was tapped in the left lower quadrant and two gallons of yellow liquid evacuated "which answered in every respect to bile. . . . It was bitter, became green on the addition of acids, and when evaporated to dryness, deflagrated with niter."

The fluid reaccumulated and he was again tapped on the thirty-seventh day. This time the trocar perforated an intes-

tine and the boy died of peritonitis five days later (six weeks after his accident).

The autopsy was performed by Mr. Thomas Skeete,[1] who reported the case at great length and with great accuracy in the *London Medical Journal*, 1785. He found in the abdomen between two and three gallons of dark bilious fluid, confined by adhesions chiefly to the right side. The liver was removed from the body "with a view to examine its under surface and to inquire particularly into the state of the gall-bladder and biliary ducts. In consequence of adhesions to the stomach and neighboring parts, nothing satisfactory with regard to the exact place at which the injury had been received could be ascertained."

This is the earliest case which the writer has found of intraperitoneal bile effusion without discoverable lesion of the bile tract or alimentary canal. There is no doubt, in this case, that a rupture had occurred, probably of the common duct. The fact remains, however, that none could be found at autopsy with the specimens on the table.

At the 1905 meeting of the American Surgical Association, Dr. Maurice H. Richardson,[2] in a general discussion of diseases of the bile tract, stated that in one instance he had "found the right upper quadrant flooded with bile which had escaped from a gall-bladder which was apparently normal. Drainage was successful." This is the first suggestion that the writer has found that bile may pass through an apparently normal gall-bladder. Further particulars of this case regarding the examination of the cystic and common duct and duodenum do not seem to be on record. It is to be supposed, however, that an operator of Dr. Richardson's skill and experience would undoubtedly have made careful examination of these parts.

Five years later, namely, 1910, Clairmont and von Haberer,[3] assistants of von Eiselsberg, of Vienna, reported the case of a patient on whom they had operated February 10 of that year, evacuating from the peritoneal sac an estimated quantity of

[1] London Med. Jour., 1785, vi, 274.

[2] Tr. Am. Surg. Assn., 1905, xxiii, 217.

[3] Loc. cit. in tabula.

7 or 8 liters of a liquid that had all the gross characteristics of bile. Careful search at both operation and autopsy failed to reveal any perforation of the gall-bladder or bile ducts or of the stomach or duodenum or any spot which could be suspected to be such. The patient was a sixty-four-year-old man with jaundice from obstruction of the common duct with a large stone. Owing to the unexpected condition found at operation no chemical examination of the liquid was made to establish positively its biliary nature. However, neither then nor thereafter did the operators express any doubt that the effusion was bile.

It so happened that, prior to this time, Clairmont and von Haberer had made experimental ligation of the common duct in dogs to note the effect of this procedure on the excretion of urine. In 4 of their dogs the occlusion of the common duct had caused death with intraperitoneal bile effusion without perforation of the bile tract.

These animal experiments, taken in connection with the operative and postmortem findings in their patient, convinced them that they had discovered a previously unnoticed complication of obstruction of the common duct, namely, *a permeability of some part of the bile tract, which, being in a pathological state, permits the transudation of bile into the peritoneal sac, by a process of filtration, when no gross perforation exists.*

Since the publication of Clairmont and von Haberer's paper 15 additional cases have been published, 7 in Germany, 4 in France, and 1 each in Italy, Switzerland, Sweden, and America. It has been assumed by nearly all of those who have reported these cases that the effusion of bile, usually massive, permeated the wall of the bile tract by a process of filtration, without any gross defect, according to the theory of Clairmont and von Haberer. This assumption, however, has been vigorously opposed by a number of authors, who explain the pathological process in various other ways, and by some who question the biliary nature of the effusion itself.

A critical examination of the cases reported shows such a lack of uniformity in the symptoms and course of the disease; in the

condition of the bile tract, as shown at operation, autopsy, and by examination of specimens, and in the apparent causes of the changes present that it must be concluded that the bile effusion in these cases is not the result of any definite pathological process.

Before making an analysis of the reported cases it may be well to give a brief history of the personal case which directed the writer's attention to this subject.

Author's Case.—The patient, a boy, aged twelve years, was admitted to the Mercy Hospital, Pittsburgh, February 6, 1916, with the following history: When two and a half years old he had typhoid fever, which confined him to bed for six weeks, and from which he made a good recovery; at three years he had whooping-cough; at four years, scarlet fever, with enlarged cervical glands; at five years, dysentery, with vomiting, severe abdominal pain, and bloody mucous passages; this illness lasted ten days. For the next two and a half years he was never well; was weak and thin; always tired; could not go up stairs without assistance. At the age of seven and a half years he had adenoids removed.

In his eighth year he began to have attacke of abdominal cramp with vomiting of bile. Most of the pain was in the right upper quadrant. He was never jaundiced. Tenderness over the gall-bladder was usually marked. His attacks usually lasted two days, and were so severe that the neighbors would say, "Joe is having one of his spells again." During his eighth and ninth years he had about a dozen such attacks, but for the last three years he has had only four attacks.

Ten days before his admission he was in a rather rough game in which larger boys "piled" on him as he lay on the ground. That evening he came home sick with what proved to be an attack of tonsillitis. In four or five days he was apparently well and returned to school. Two days before his admission he was taken with colic at school and had to be assisted home. The abdominal cramps were attended by nausea and vomiting, with slow pulse and but slight elevation of temperature.

The family physician was called and found that practically all of the patient's early pain and tenderness was high up on the right side of his abdomen. At the end of forty-eight hours the patient was still vomiting and his pulse was quite rapid; his abdomen was markedly distended and rigid. It was the opinion of his physician, who had seen him in former attacks, that, notwithstanding the patient's youth, the trouble was located in the gall-bladder.

Condition on Admission. Patient has the appearance of being seriously ill. Pulse is rapid and temperature but little above 100°. Abdomen is markedly distended and everywhere rigid. There is acute tenderness at McBurney's point and some tenderness all over the abdomen.

A diagnosis of diffuse appendicular peritonitis was made and immediate operation performed.

Pathological Condition Found. Peritoneal cavity swimming with a mixture which seemed to be about half bile and half seropus. This gushed out as soon as the abdomen was opened and flooded the floor before a basin could be brought. The intestines were injected and the ascending colon very much thickened. The appendix was reddened, but not more than the other serous surfaces in the neighborhood. It was not otherwise diseased. Peritoneum of the ascending mesocolon and that covering the common duct, edematous, glassy, and green. Wall of common duct black and apparently totally gangrenous. Gall-bladder tense, red, and full of dark bile and mucopus. Common, hepatic, and cystic ducts not obstructed. No perforation to be found in bile tract, duodenum nor stomach, nor point suspicious of perforation by reason of adhesions or plastic lymph.

Mechanics of Operation. Incision at margin of right rectus for exposure of appendix, which was delivered and removed. Incision was freely extended upward to give complete exposure of the bile tract. The gall-bladder, cystic and common ducts, as well as the stomach and duodenum, were carefully examined for perforation, with negative result. The common duct was exposed by incising the edematous peritoneum over it, and it

was found to be black and apparently gangrenous. It was opened and explored by passing a uterine probe into the duodenum and into each hepatic duct. All ducts were found free from obstruction by stone or otherwise. The mucous membrane of the common duct, as well as its wall, was black and appeared to be in a state of gangrene. This condition of the common duct has a parallel in those unusual cases in which the gall-bladder wall is deeply congested, its mucous membrane black, and which, for one reason or another, are treated by drainage and recover without sloughing.

A rubber drain was passed into the hepatic duct and anchored with catgut stitch to the common duct, whose opening was closed snugly around it. The gall-bladder was opened and found to be free from calculi. The margin of the opening was overwhipped and the gall-bladder was drained with a rubber tube. Fresh bile soon began to drain from both gall-bladder and common duct. The region of the common duct was protected by two cigarette drains and a rubber tube, the peritoneal cavity was mopped out to remove the bile and exudate that remained, and the abdomen was closed without drainage except as stated.

Subsequent Course. The peritonitis subsided at once and the patient made a good recovery, retaining a biliary fistula, with variable flow, for about six months. This was regarded as a favorable factor, considering the previous history of the boy and the marked condition of his bile tract found at operation. At the end of six months the fistula spontaneously closed and the boy has since remained well.

Comment. For a boy to suffer from his eighth to his twelfth year with repeated attacks which, in an adult, would be considered biliary colic is unusual. The operative findings, however, confirmed this diagnosis, which had been positively held by his medical attendant. The clear history of a severe typhoid fever when the boy was but two and a half years old is very pertinent in this connection. It is unfortunate that cultures were not made of the contents of the gall-bladder to determine the presence or

absence of the Bacillus typhosus. A postperitoneal traumatic rupture of the common or hepatic duct, with infiltration of bile and subsequent infection of the effusion by organisms from the infected tonsils, is a strong possibility.

There are two questions, however, of paramount importance in the interpretation of this case: First, was this really bile that gushed in such a flood from the peritoneal cavity? and secondly, if so, how did it get there? We may be better able to answer these questions after consideration of the facts brought out concerning similar and cognate cases hitherto reported.

THE TABLE. Cases have been considered eligible for listing in the appended table only when the gall-bladder, cystic and common ducts, stomach and duodenum have been satisfactorily examined at operation or autopsy or both.

Nauwerck and Luebke,[1] as well as Sick and Fraenkel.[2] would go much further and exclude all cases that had not come to autopsy and had the gall-bladder examined microscopically by serial sections. This seems to be an unreasonable requirement.

REACTION OF THE PERITONEUM TO EFFUSED BILE AND POSSIBILITY OF SPONTANEOUS CLOSURE OF PERFORATION. The reaction of the peritoneum to the presence of effused bile depends on whether the bile is sterile or infected. Infected bile, of course, causes a peritonitis virulent in proportion to the activity of the bacterial content. Sterile bile, on the other hand, is well tolerated. Experiments made in 1903 by Fraenkel and Krause[3] showed that "opening of the gall-bladder by means of laparotomy in guinea-pigs and rabbits under aseptic precautions did not injure the health of the animals in the slightest degree. If one kills such an animal after some time, one is convinced that the unsutured wound has cicatrized with partial obliteration of the gall-bladder and with adhesions to the surrounding tissues."

Clinical cases are by no means lacking to show that *bile even*

[1] Loc. cit. in tabula.
[2] Beitr. z. klin. Chir., 1913, lxxxv, 687.
[3] Ztschr. f. Hyg., Bd. xxxii.

in enormous quantity may be well tolerated by the peritoneum and that spontaneous closure of a traumatic lesion of the bile tract may occur after repeated tappings and be followed by recovery.

Mr. Fryer,[1] in 1813, reported the case of a boy, aged thirteen years, who had received a violent blow over the liver by the shaft of a cart June 7, 1803. Eleven days later he was jaundiced and had acholic stools. Three weeks after the accident he was tapped and 13 *pints* of pure bile drawn off. On the thirty-third day he was again tapped and 15 *pints* of bile withdrawn. On the forty-second day 6 *pints* were removed. Complete recovery followed and he was known to be well ten years later.

Mr. William Robert Barlow,[2] in 1844, reported the case of a man who had had a probable rupture of the common duct from lifting a heavy ladder. He developed a localized swelling in the right hypochondrium and was tapped at the end of six weeks and 7 quarts of pure bile drawn off. Thereafter he was tapped successively on the fifty-fourth, sixty-fourth, seventy-third, eighty-first, and ninety-first day, the total amount of bile removed being 52 *quarts*, averaging more than 10 *ounces a day* for the whole period. No bile passed into the intestine during the entire thirteen weeks. The man made a complete recovery in five months.

Bargellini,[3] in 1897, reported the case of a young man who fell against a drinking fountain, striking on his hepatic region. He was ill for twenty days and then returned to his work. Three and a half months after the injury his abdomen was found to be full of liquid. He was tapped and 10 *liters* of a dense liquid of an intense ochre-yellow color, almost exactly identical with bile, was removed. The patient recovered without further tapping.

On the other hand, the *rupture of the bile tract may not close* and still the bile effused may for a long time be tolerated by the peritoneum.

[1] Medico-Chirurg. Tr., London, 1813, iv, 330.
[2] Ibid., 1844, ix, 378.
[3] La Riforma Med., 1897, iii, 214.

No. and operator.	Date, age, and sex.	Duration symptoms.	Previous icterus.	Injury.	Condition of bile tract.	Nature of effusion.
1 Clairmont and v. Haberer	Feb. 6, 1910 M. 64 years	27 days	Yes	None	No perforation; dark spot on common duct as of beginning gangrene; calculus size of peachstone in common duct	7 or 8 liters of intensely yellow odorless ascitic fluid
2 Ritter-Schievelbein	Jan. 14, 1910 M. 32 years	6 days	Not mentioned	None	Gall-bladder swollen, tightly distended, smooth, glistening, edematous, greenish; oozing from gall-bladder is a hardly visible clear, yellow liquid, which stains gauze light yellow; small stones in gall-bladder and cystic duct; gall-bladder contained muddy, grayish-green bile	Abundant clear, serous strikingly yellow-colored liquid
3 Doberauer	July 22, 1909 M. 38 years	3 days	None	Hit by a branch from a falling tree 3 days before	Gall-bladder thin, tightly filled; no concretion palpable; no lesion of cystic nor common duct	Entire abdominal cavity filled with bile ascites
4 Doberauer	Aug. 23, 1909 M. 16 years	3 wks.	None	None	Gall-bladder filled, smooth, thin; no stones; no stones in cystic nor common duct	Abdomen full of dark, viscid bile mixed with a little pus
5 Johansson, of Sabbatsberg	Jan. 27, 1912 F. 76 years	1 day or 1 month	None	None	Gall-bladder thickened and containing one movable stone; no perforation; gall-bladder contained green viscid bile	The whole right side of the abdomen filled with green bile
6 Favreul	Aug. 15, 1912 F. 52 years	....	None	None	Gall-bladder enlarged and thickened; mucosa thickened but not ulcerated; no calculi, no perforation in gall-bladder or ducts; common duct dilated	Liquid tinged with bile

Bacter. examination.	Exam. at operation.	Examination at autopsy.	Examination of specimens.	Treatment.	Result.	Publication.
None at operation	Evidently thorough	No perforation of bile tract; Gram-positive cocci in pairs and short chains in peritoneal fluid; 2 small stones in common duct; mucous membrane of gall-bladder inflamed	None recorded except of liquid	Stone pushed into gall-bladder and extracted; gall-bladder drained	Death	Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1910 xxii. 154.
Negative	Very thorough	No autopsy; patient recovered	Gall-bladder showed no perforation; wall much thickened	Cholecystectomy; common duct not drained	Recovery	Beitr. z. klin. Chir. 1910, lxxi. 570.
....	Evidently very thorough	....	....	Tamponade and tube drainage to region of common duct; dry mopping	Recovery	Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1911–12. xxiv. 395.
Typhoid bacilli in pure culture	Evidently very thorough	....	....	Dry mopping; cholecystotomy; drainage	Recovery	Ibid.
....	....	No stone nor perforation of bile ducts	Gall-bladder contained green bile and stone; microscopic examination shows great inflammation	Cholecystectomy	Death	Hyg. Med. och Farm. Manad., 1913, i. 393.
None	Yes	Hard tumor in head of pancreas	No microscopic examination.	Drain in pelvis	Death in 3 hours	Gaz. méd. de Nantes 1913, xxxi. 161.

No. and operator.	Date, age, and sex.	Duration, symptoms.	Previous icterus.	Injury.	Condition of bile tract.	Nature of effusion.
7 Brugnatelli, of Pavia	Sept. 20, 1912 M. 26 years	12 days	Yes	Riding a bicycle; thrown against a carriage	....	4 liters in 2 aspirations of reddish bile liquid; clear reaction of bile pigment demonstrated by accurate chemical examination
8 Wolff, of Gelsevkirschen	1912	2 days	None	....	Widespread adhesions at the hilum of the liver and gall-bladder and duodenum; numerous stones in the gall-bladder; adherent but unchanged in other respects	Muddy, bile-colored purulent exudate in considerable quantity
9 Guibe	Feb. 12, 1913 F. 68 years	13 days	None	None	Gall-bladder full of bile under tension; no calculi	An abundance of extremely bilious liquid
10 Salager and Roques	Mar. 22, 1913 32 years	2 days	None	None	Gall-bladder full of a liquid thicker than the effusion, but like it in other respects; gall-bladder engorged and distended but not perforated; calculus in common duct size of olive pit	Saffron-yellow liquid in peritoneal cavity; effusion colored green by picric acid, but not by any other substance; Pettenkoffer's test negative
11 Madlener	Pub. 1913 63 years	2 days	Slight	None	No discoverable perforation; gall-bladder inflamed; bile tract covered with plastic adhesions; stones in gall-bladder and common duct	½ to ¾ liter exquisitely bile-colored exudate

Bacter. examination.	Exam. at operation.	Examination at autopsy.	Examination of specimens.	Treatment.	Result.	Publication.
....	....	6 liters of liquid found at autopsy which had reaction of bile; diffuse fibrinous peritonitis; all abdominal organs entirely or partly covered with fibrin; no trace of perforation of gall-bladder or any of the ducts; gall-bladder distended by injection through a hypodermic syringe with negative result	....	Aspiration of 3 liters of bile liquid; 2d aspiration (12 days later) of 1200 c.c. of same	Death	Policlinico, Roma, 1913, xx, 544.
None mentioned	Not very thorough	No perforation of gall-tract, stomach or intestine; no ulceration anywhere nor suspicious point; gall-bladder macroscopically normal	None mentioned	Irrigation of peritoneal cavity; drainage of gall-bladder	Death from peritonitis	Berl. klin. Woch., 1912, xlix, 2354.
None	Superficial	A great quantity of free bile; normal except for its thickness; no false membrane; no evidence of perforation of bile tract; cancer of head of pancreas; secondary cancer of liver; nodule obstructing common duct	....	Drainage	Death	Rev. de Chir., 1914, xlix, 233.
None	No operation	Gall-bladder and ducts intact	....	Patient died without operation	Death	Montpellier Med., 1913, lvi, 67.
None	Apparently as careful as possible in a place covered with adhesions and plastic lymph	Patient recovered	None	Cholecystostomy and probably choledochostomy	Recovery	Beitr. z. klin. Chir. 1913, lxxxiii, 620

No. and operator.	Date, age, and sex.	Duration, symptoms.	Previous icterus.	Injury.	Condition of bile tract.	Nature of effusion.
12 Henschen	July 17, 1914 64 years	1 day	None	None	Gall-bladder dark brown, tightly filled, not perforated; no stones nor perforation in the bile tracts	Entire upper abdomen filled with olive green muddy, not stringy bilious fluid; ¾ liter streams out
13 v. Kutscha	21 years	....	None	....	Acute cholecystitis	....
14 Leriche and Cremieu (Lyons)	Feb. 25, 1913 F. 35 years	2 days	Slight	None	Gall-bladder enormous, distended, rigid, full of calculi; oozing of a true bile dew, or greenish rain coming out in droplets; no trace of perforation of gall-bladder or bile ducts	1½ liters clear bile liquid without pus; one would have said "an ascites strongly colored with bile"
15 Gibbon, of Philadelphia	....	....	....	....	Gall-bladder full of bile; no stone; gall-bladder red and inflamed; bile was seeping from gall-bladder wall, ducts and duodenum examined	A lot of free bile in peritoneal cavity
16 Nauwerck and Luebke (Chemnitz)	May 21, 1912 M. 56 years	7 days	Yes	None	Gall-bladder tightly distended with black, syrupy viscid bile; no opening in gall-bladder or ducts	Great quantities of bile in true pelvis in rest of abdominal cavity

Bacter. examination.	Exam. at operation.	Examination at autopsy.	Examination of specimens.	Treatment.	Result.	Publication.
None mentioned	Yes	Mucous membrane of gall-bladder unchanged; phlegmonous inflammation at junction of gall-bladder and cystic duct	Spot on neck of gall-bladder covered with fibrin and wall destroyed with ulceration	Mikulicz drain	Death in a few hours	Cor.-Bl. f. schweiz. Aerzte, 1915, xlv, 503.
....	....	....	....	Cholecystectomy; drainage of common duct	Recovery	Wien. klin. Woch., Mar. 15, 1912.
None mentioned	Apparently very thorough	....	Gall-bladder wall 4 cm. thick, greenish, edematous	Cholecystectomy	Recovery	Lyon méd., 1913, cxx, 856.
None mentioned	Thorough	....	....	Cholecystostomy	Recovery	Ann. Surg., 1913, lviii, 430.
Effusion sterile; colon bacilli in bile of gall-bladder	Thorough	Common duct not obstructed; water distention through a cannula shows no leakage from bile tract; membrane of gall-bladder dark brown to blackish green	Gall-bladder examined microscopically with serial sections; minute defects at different layers found; no permeability with bristle	Aspiration of gall-bladder with suture and drainage of abdomen	Death	Berl. klin. Woch., 1913, l, 624.

Labrosse,[1] a pupil of Jaboulay, of Lyons, in his inaugural thesis of 1912, reported the case of a young man, aged seventeen years, who two years before had fallen from a ladder onto a wall, striking on the right hypochondrium. Eight to ten days later his abdomen began to enlarge and so continued until he came under Jaboulay's care. The abdomen was opened and there flowed out 8 *to* 10 *liters of bile*. A small perforation was found in the gall-bladder, which must have existed for two years, and the peritoneum was thickened and covered with false membrane. The patient died two months later of secondary infection through the drainage opening.

Very interesting in this connection is the case of Ratjen (abstracted by Sick and Fraenkel).[2] The patient was a fifteen-year-old boy, who had sustained no severe injury or external trauma. He had, however, a continually increasing effusion of bile into the peritoneal cavity, as could be known by a constantly increasing circumference of the body, which necessitated repeated punctures. The patient finally recovered without open operation.

Nature of the Effusion. An examination of the table will show that in not a single instance in which the abdomen was opened during life was a chemical examination of the liquid made to prove that it was bile. During the operation it does not seem to have occurred to any of these surgeons that the effusion could be anything else than bile.

In only one of the cases in the list was bile pigment demonstrated by chemical examination, that of Brugnatelli.[3] In this case aspiration of the liquid was twice practised and the patient died. This case is not without suspicion of rupture, having been caused by injury and exhibiting at autopsy a fibrinous peritonitis. The report of the autopsy states that all the abdominal organs were entirely or partly covered with plastic lymph. Under these circumstances an unrecognized perforation might easily have existed.

[1] Contribution a l'étude du choleperitoine spontane, Lyon, 1912.

[2] Ibid.

[3] Loc. cit. in tabula.

The only other case in which a chemical examination of the effusion was made was that of Salager and Roques.[1] The patient died without operation, and an examination of a small quantity of the liquid by Pettenkoffer's test was negative.

If, therefore, a chemical examination of the effused liquid is made a condition for the acceptance of this pathological picture, then the whole case of a "bile peritonitis without perforation" falls to the ground.

On the other hand, it seems unlikely that such a considerable number of observers, many of them known to be skilful and experienced, should be mistaken in the recognition of a liquid so characteristic as bile.

This matter remains in doubt.

In 2 reported cases, those of Schievelbein[2] and Johannson,[3] the authors found greenish bile in the gall-bladder and clear, yellow effusion in the abdomen; and strangely enough this has been held to be a proof that the liquid was changed in color and consistence by filtering through the gall-bladder wall.

If some or all of these effusions are not bile, to what may their color be ascribed? The bilious hue of the ascitic fluid in jaundiced patients is a matter of common knowledge, and still this fluid is not bile. Mr. Thomas Skeete[4] pointed out this distinction in 1785 in the report of his case above noted.

Saffron-yellow peritoneal effusions are occasionally seen by all surgeons when necrotic tissue is present, such as a gangrenous gall-bladder or an appendix. These effusions have been subjected to chemical analysis by various surgeons and pathologists, notably by Davis,[5] of Philadelphia, and Roger and Derrien,[6] who have found the color to be due to pigments derived from the blood. Askanazy,[7] of Geneva, also has evolved what he calls "the law of the pigmentophilie of necrotic tissue," which enables it to seize coloring matters and then to spread them.

Anyone who is disposed to be at all critical and to doubt

[1] Loc. cit in tabula. [2] Ibid. [3] Ibid. [4] Ibid.
[5] Ann. Surg., 1906, xliv, 718. [6] Montpellier Méd., 1913, lvi, 67.
[7] Berl. klin. Wchnschr., 1913, Nr. 36, 1645.

the existence of a "bile peritonitis without perforation" can find reasonable grounds for disputing the case of Clairmont and von Haberer because of the general icterus; and the cases of Schievelbein,[1] Favreul,[2] Salager and Roques,[3] Madlener,[4] and Leriche and Cremieu[5] because of the presence of incipient or complete gangrene of the gall-bladder.

Condition of the Bile Tract. It is very interesting to notice that inflammatory, or carcinomatous lesions or stones were present in 13 of the cases in the table, and of the other 3, 2 were cases following trauma, and in 1 typhoid ulceration was probably present, the bacilli in pure culture being found in the effused liquid. Stone was present in 7 cases, obstruction of the common duct in 4 cases, and cholecystitis in 10 cases.

In 81 per cent. of these cases, therefore, there was undoubtedly a pathological condition of the gall-bladder or bile ducts, and this, in itself, would to a certain extent support the observers in their assumption that the effused liquid was bile.

Bacteriological Examination of the Effusion. Bacteriological examination here is less important than chemical. It was made of the fluid found at autopsy in 1 case (Clairmont and von Haberer), cocci in pairs and short chains being found; of the fluid found at operation in 1 case (Doberauer), Bacillus typhosus being in pure culture; it was negative in 2 cases (Schievelbein, Nauwerck and Luebke); in the other cases no culture was made or the subject was not mentioned.

There Are a Number of Possible Channels for Escape of the Effusion into the Peritoneal Cavity.

1. *Filtration through the Wall of the Gall-bladder or Bile Ducts, Rendered Abnormal by Disease or Injury.* This theory, originally proposed by Clairmont and von Haberer, has received the support of 17 out of 19 who have reported cases or written at length on the subject. Schievelbein and also Askanazy summoned to the support of this theory the canals of Luschka,

[1] Berl. klin. Wchnschr., 1913, Nr. 36, 1645. [2] Loc. cit in tabula.
[3] Ibid. [4] Ibid. [5] Ibid.

while Sven Johansson found in his case a great dilatation of the lymphatic vessels, and considered this an element in the so-called filtration process.

No doubt the great majority of surgeons, if called on to express an opinion as to the likelihood of such a process, would be disposed, on general principles, to deny the probability of the filtration of bile through the unperforated wall of the gall-bladder or bile ducts, such a process being contrary to all experience in these or other hollow organs of the abdomen. They would consider that an undiscovered opening existed or that the liquid was not a true bile or bile mixture.

At the same time there are a few cases which are very difficult to explain without accepting the filtration theory, namely, those of Gibbon,[1] Johansson,[2] and Guibe.[3]

2. *Microscopic Perforation.* A perforation so small as to be detected only by the microscope and so devious in its course as to be found only by serial sections would seem to have very little claim to be the channel of escape for enough bile to fill the abdomen. Such, however, is the claim in the case of Nauwerck and Luebke. This theory of a devious, microscopic perforation is rendered less probable by the fact that the contents of the gall-bladder contained colon bacilli while the peritoneal bile effusion was sterile.

3. *Small Perforation Hardly Visible to the Naked Eye.* Sick and Fraenkel,[4] in 1913, reported the case of a thirty-two-year-old man who the day after a slight injury of doubtful import had severe peritonitic symptoms. On the fourth day he was opened. The abdomen contained a great quantity of clear yellow bile. A small opening was found in the gall-bladder about as large as the puncture of a hypodermic needle. From this opening clear bile was exuding in little drops. Elsewhere the bile tract was normal. The gall-bladder was excised and found to be normal, except for this opening, which just sufficed for the passage of a bristle diagonally. This case, while not coming within the scope

[1] Loc. cit. in tabula. [2] Ibid. [3] Ibid. [4] Ibid.

of the present inquiry, has a very decided bearing on another possible explanation for these cases, namely:

4. *Rupture Subsequently Healed, Leaving an Unabsorbed Effusion.* This is a possibility which should not be overlooked, for such an occurrence has been frequently observed and a number of such cases are referred to in the earlier part of the present paper.

It should not be forgotten, however, that in these cases the opening is probably always closed by adhesions to other organs and especially to the omentum. This is the method of closure observed in experimental cases and is the normal way of cure in perforations of all the hollow organs of the abdomen.

In the cases under consideration, and here tabulated, no such adhesions exist, which makes this explanation improbable, to say the least. Another possibility remains, namely, that the adhesions have subsequently pulled loose, which also is unlikely.

5. *Rupture of an Intrahepatic Bile Canal.* In 1905 Nauwerck[1] exhibited at the Medical Society of Chemnitz the specimens of 2 patients jaundiced from stone obstruction of the common duct. Each of these specimens showed dilatation of the subserous bile canals on the surface of the liver, and a rupture of one of these canals, in 1 case slit-like, and in the other almost as large as the head of a pin.

In 1909 Karillon,[2] one of Nauwerck's students, reported 2 additional cases of the same nature. Nauwerck and Luebke in 1913 reported a fifth case with 1200 c.c. of almost pure bile in the peritoneal cavity, with a subserous bile canal showing a rupture the size of the head of a pin.

In the same year Vogel,[3] of Vienna, reported a similar case. Five additional cases have been reported, but in every one of these cases there was obstruction of the common duct by cancer or stone. In not one of them was the patient operated on and

[1] München. med. Wchnschr., 1905, liii, 931.
[2] Inaug. Diss., Karillon, Leipsig, 1909.
[3] Wien. klin. Wchnschr., 1913, xxvi, 1153.

the discovery of such a condition at operation is probably impossible.

As an explanation of 2 cases under consideration this condition is considered possible, but in the highest degree improbable.

6. *Postperitoneal Rupture or Perforation of the Common or Hepatic Duct by Trauma or Ulceration, followed by Bile Effusion into the Postperitoneal Tissue and Subsequent Rupture into the Peritoneal Cavity at a Point More or Less Removed from the Site of the Perforated Bile Passage.* This method for the escape of bile into the peritoneal cavity has not been suggested by previous writers on this subject.

Postperitoneal effusion of bile, from rupture or ulceration of the common or one of the hepatic ducts, is one of the rarely recorded pathological conditions. An early and very typical case of this kind is that of Mr. Thomas Wainwright,[1] of Dudley, England, reported in 1799.

The patient fell from his horse and received a violent blow in the epigastrium, which caused profound shock and unconsciousness. The following day the epigastrium was swollen, tense, discolored, and very tender. For several days the skin, conjunctivæ, and urine were tinged with bile. The pain was constant and very acute, and, after some time, extended gradually down the right side to the bottom of the belly and from thence to the left side; the abdomen was now tumid and an obscure fluctuation was felt. Eight weeks after the accident the patient died.

Autopsy. The autopsy was most interesting and evidently conducted with the greatest care. The bile had apparently escaped from a subserous rupture of the hepatic duct, where, for a space two inches in diameter, the peritoneum was lifted and formed part of the sac wall. From its origin at the inferior surface of the liver the sac was traced under the diaphragm; the fluid contained having dissected the pleura from the ribs and formed a tumor which compressed the right lung; thence descend-

[1] Med. and Phys. Jour., London, August, 1799.

ing in the reverse course of the ascending colon, and pushing the caput coli obliquely inward, the sac passed into and completely filled the pelvis, pressing the urinary bladder into a very contracted space. Ascending from the pelvis the sac followed the reverse course of the sigmoid flexure of the colon to the diaphragm, where it terminated. The right and left divisions of the sac communicated only in the pelvis, the spine forming a barrier between them. The sac held 3 or 4 gallons (by computation) of a grass-green colored fluid, which was evidently mixed largely with bile.

A plastic peritonitis was present, but no bile was found in the peritoneal cavity, notwithstanding the extensive subserous dissection, the long standing of the condition, and the tension of the enormous quantity of bile contained in the subserous sac.

That an undoubted postperitoneal rupture of some part of the bile tract may occur and elude a careful search for it at autopsy is shown by a case reported by Routier[1] in 1910. In June, 1901, he performed a cholecystectomy for stone in the cystic duct and gall-bladder. The patient recovered and returned to her work. She later returned with a very deep, right-sided extraperitoneal abscess. This Routier evacuated and drained. The next day *bile began to drain from the tube and flowed in abundance until the patient's death, four days later.*

He reports that "at the autopsy it was impossible for us to find the place from which the bile had escaped, which had filled the drained cavity. There had been an infiltration of bile all all along the vertebral column; we discovered the integrity of the cicatrix resulting from the former cholecystectomy; and we found a calculus with facets obstructing the ampulla of Vater and a small stone ramifying in the right branch of the hepatic duct. The common duct was a little dilated, but the rest of the intrahepatic bile tract appeared to be normal."

Interpretation of Author's Case. Returning to the questions propounded above concerning the author's case, it may be

[1] Bull. de la Soc. de chir. de Paris, 1910, xxxvi, 1311.

said that he is still convinced that the liquid effusion was a bile mixture, and that, taking all the facts into consideration, the most probable channel of its escape is the one last considered.

The history of previous attacks of cramp in a young boy always considered biliary colic; acute, almost gangrenous cholecystitis and cholangitis as demonstrated at operation; history of an injury such as might cause a bursting rupture of a gall tract; intense edema of the ascending mesocolon and the postperitoneal cellular tissue; abundant bile effusion; prompt subsidence of all symptoms by free drainage of the bile tracts, taken together, seem to make a picture explained only on the hypothesis of a postperitoneal rupture of a bile tract, with secondary rupture into the peritoneal cavity.

Treatment. The conditions present in the recorded cases being so varied, no valuable conclusions can be drawn from the results of the different methods of treatment. It may be stated, however, that the gall-bladder was drained in 5 cases, with 3 recoveries and 2 deaths; the gall-bladder was removed in 4 cases, with 3 recoveries and 1 death; the hilum of the liver was tamponed in 3 cases, with 1 recovery and 2 deaths; the pelvis was drained in 2 cases, both fatal; aspiration was practised in 1 fatal case and another patient died without operation.

The general mortality, therefore, was 56 per cent.

Of the 14 cases operated on, in 6 the bile tract was drained with a mortality of $33\frac{1}{3}$ per cent.; in 8 the bile tract was not drained, and in them the mortality was 62.5 per cent.

Leaving out of consideration the results of the recorded cases it would seem to be wise, when there is a peritoneal cavity flooded with bile from an undiscovered place of exit, to dry mop the cavity and drain the common duct, treating the gall-bladder as its condition requires. The chief indication is to prevent further effusion by tapping the great bile canal.

Conclusions. 1. There is no typical disease picture to account for a bile peritonitis without evident perforation of the bile tract.

2. There is a group of recorded cases, with abundant effusion in which no perforation could be demonstrated at operation or autopsy.

3. These cases may be accounted for in a variety of ways, some fitting one hypothesis and some another, no one theory suiting all cases.

4. The bilious nature of the effusion still lacks the proof of a chemical examination. It is to be hoped that subsequent cases may be subjected to the test for bile acids and bile salts.

5. The cases being so unusual and so atypical, the diagnosis has not yet been made even tentatively, the real condition having never been even suspected in any of the published cases.

6. Many surgeons may have seen such cases and considered them undiscovered perforations.

7. The treatment should be dry mopping of the peritoneal cavity and direct drainage of the common duct.

DISCUSSION

Dr. William L. Estes, South Bethlehem, Pa.:

I wish to put on record a case which I operated, thinking it was a case of peritonitis from ruptured appendix. It proved to be a case in which the peritoneal cavity was filled with bile; there was no visible perforation in the gall-bladder. I found the gall-bladder fibrous and whitened, but careful search of all the ducts and gall-bladder could discover no apparent reason for the bile being in the peritoneum. I attributed it to a perforation with closure, as there were some adhesions of the transverse colon and contiguous peritoneum. The case recovered with drainage through the iliac region, and thorough drainage of the gall-bladder for some time.

HYPERNEPHROMA IN THE FOLDS OF THE FALCIFORM LIGAMENT OF THE LIVER

By F. N. G. STARR, M.B. (Tor.)
TORONTO, CANADA

January 24, 1917, I was consulted by a female patient, a spinster, aged thirty-five years. She complained of pain between the shoulders, extending up the back of the neck; sometimes severe headache. She had a sallow complexion, a weary expression of countenance, and looked much worn. The breathing was labored. There was a history of a gradual loss of appetite with flatulence coming on immediately after eating. The bowels were regular; she weighed 159 pounds. There was no menstrual disturbance.

A physical examination revealed a mass most prominent in the epigastric region, extending from the costal margin above to about four inches below the level of the umbilicus. There was dulness on percussion over the entire mass, and this was continuous on the right side with the liver dulness, which extended upward to the lower border of the third costal cartilage in front. There was resonance under the costal margin on each side and this continued down to Poupart's ligament. Between the lower end of the mass and the symphysis pubis there was also resonance. As indicated in the diagram (Fig. 1) the growth extended a little more to the right than to the left. One could detect a definite though dull and slowly transmitted fluctuation wave. On palpation there was a distinct pulsation over the whole area. With the stethoscope one could hear a loud *bruit*, while to the right of the middle line, the *bruit* was

not only loud, but crudely musical, resembling somewhat the noise of an express train passing through a closed station.

FIG. 1

FIG. 2

After an opaque meal the *x*-rays showed the stomach crowded well to the left side and vertical (Fig. 2). It emptied on time. Renal function was normal.

The diagnosis lay between (*a*) an atypical pancreatic cyst, but there was no history of an injury, nor of frequent attacks of epigastric pain, nor was there the prostration that I have observed in the few cases which have come under my observation; (*b*) an hydatid of the liver was kept in mind, but the patient had always lived in Toronto and even in holiday time she had not visited sheep-growing areas; the right lobe of the liver did not seem to be invaded, but there was that "jelly-like" fluctuation that is described as almost characteristic; (*c*) a collection of fluid in the lesser sac due to a pathological closure of the foramen of Winslow came into one's mind, but there was no history of any intraperitoneal trouble that might give rise to such closure.

Operation. February 28, 1917. An incision was made a little to the left of the median line extending from the ensiform cartilage to a point half-way between the umbilicus and the pubes, when an enormous reddish-brown tumor (Fig. 1) presented in the wound, having across it a network of fine yellow lines. Had the growth been in the posterior mesentery or in the retroperitoneal tissue, one would at once have recognized its character from its appearance. It seemed to have a broad attachment above, and finally I discovered that it was between the layers of the falciform ligament, which were of course enormously stretched. By dividing this tissue close to the liver I was able to remove the whole mass without rupture.

As the growth was transferred to a basin, a forceps that was still attached caught on the basin and punctured the mass, some of its contents—thick grumous material—escaping into the basin. This made me realize the probably malignant nature of the growth. Consequently, in closing the abdomen I was careful to bring forward the cut edges of the falciform ligament and suture them together, along with the cut edges of the peritoneum, thus reconstructing the ligament and closing the peritoneal wound with the same suture. At the same time, should recurrence take place it is made easy of access, and the recurring growth would be extraperitoneal. The tumor weighed eight and a half pounds (Fig. 3).

The patient has made an uninterrupted recovery, is now enjoying excellent health, and weighs 138 pounds.

Prof. MacKenzie, of the department of pathology, reports: "The tumor in the gross, as received in the laboratory, is a large globular mass, about thirty centimeters in diameter. The main mass of the tumor is soft and breaks down at once when cut. It contains a large amount of blood and blood clot and when this is removed there remains a soft debris which contains a quantity of fat.

FIG. 3

"Toward the margin the tumor is firmer and of a yellowish tint and the whole is surrounded by rather firm fibrous tissue; at one side are remnants of liver tissue, apparently outside the fibrous capsule.

"The central area of the tumor is difficult to cut on account of the extensive hemorrhage and necrosis, but when sections are obtained the tissue is made up of large, rather polygonal vacuolated cells arranged as cords and columns about irregular blood sinuses. The vacuoles do not contain fat, although a

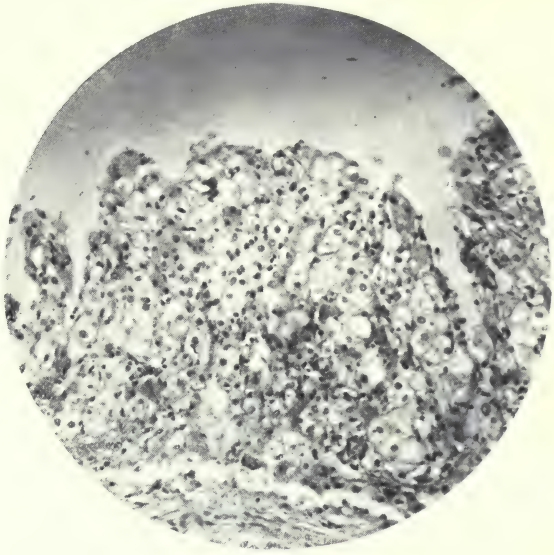

FIG. 4

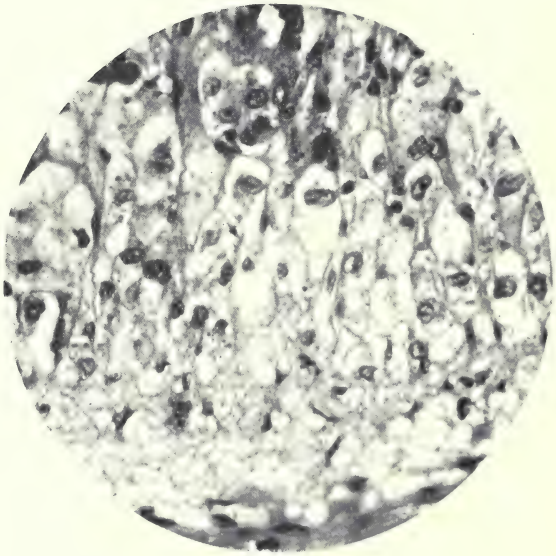

FIG. 5

good deal of fat is present as large droplets between the cells. On account of the fixation it is impossible to say whether there is glycogen in the tumor cells. The nuclei vary very much in size but are large with a large nucleolus and a relatively small amount of chromatin. Mitotic figures can be found but do not seem to be common. In places there is evidence of direct cell division. Toward the margin and more solid portion there is less fat and hemorrhage. The cells also seem more compactly arranged.

"The most interesting point is that immediately within the fibrous tissue and among the tumor cells are a few cords of liver cells. Farther in these cannot be found.

"The fibrous tissue is not a true capsule but contains bile ducts and islands of liver tissue simulating an abnormal type of cirrhosis.

"The general appearance of the tumor under the microscope more nearly approaches that of a hypernephroma than any other type, but the resemblance is not absolute.

"On the other hand, it is difficult to understand the small areas of liver cords in the margin of the tumor within the capsule and the possibility of a tumor arising from the liver itself must be thought of. The general character of the cells, and especially of the nuclei, unquestionably suggest malignancy and the prognosis should certainly be guarded."

This condition must be exceedingly rare. Pepéré[1] reports a case of hypernephroma in the right lobe of the liver, but how adrenal rests can find their way between the layers of the falciform ligament is difficult to understand, especially when one remembers that the first traces of cortical substance do not appear until the embryo has reached a length of 6 or 7 mm., by which time considerable liver substance and the inferior vena cava will intervene between it and the falciform ligament, while the chromaffin tissue from which the medulla is formed does not appear until the embryo is about 15 to 20 mm.

As the right suprarenal ridge runs on to the dorsal surface of the liver, an aberration in its migration might result in some rests

reaching the liver margin. Should it so happen that one of these rests be situated near the reflection of the falciform ligament and undergo a rapid proliferation, the line of least resistance would be downward between the peritoneal layers of the ligament.

It would be unwise for me to enter into a discussion of the histopathology as to whether these tumors really spring from adrenal rests or from the Wolffian body. This I shall leave to Dr. Louis B. Wilson,[2] of the Mayo Foundation, to whom I purpose turning over the material for further study in recognition of his masterpiece on hypernephroma.

References

1. Pepéré: Arch. de méd. de Paris, Experimentale et d'Anat. Path., 1902.
2. Wilson, Louis B.: Jour. Med. Research, January, 1914.

DISCUSSION

Dr. Stanley Stillman, San Francisco:

I regret that I cannot recall exactly the location of a tumor in connection with the liver which I have seen in the last six months. The condition was a hopeless one, but the diagnosis on section of a piece which was removed for examination was hypernephroma, and I was surprised to find that hypernephroma occurred anywhere except in the suprarenals. I was told that it is not unknown.

Dr. William B. Coley, New York City:

I was wondering whether it were possible that the tumors with a diagnosis of hypernephroma might be questioned. I do not believe it is always possible by microscopic examination to state it is a hypernephroma. I had a case a year and a half ago, a large tumor in the front part of the forearm, which had remained of slow growth for six or seven years and then started to grow rapidly. A piece was removed and sent to Cornell laboratory and pronounced typical hypernephroma. The patient was sent to me for operation. The ulnar nerve went through the tumor and I removed most of the growth. This tumor was again examined and said not to be hypernephroma. This woman I saw a few months ago and she had extensive metastasis of the chest, but no renal symptoms whatever, and the tumor had no connection with the bone. In seven years there has been no evidence of bone metastasis, no renal symptoms, and it seems that the actual condition was a primary carcinomatous tumor of the forearm.

Dr. S. J. Mixter, Boston:

It must be remembered in addition to the glandular tumors secondary to a true hypernephroma of the kidney there are cases such as those reported today which the pathologist calls hypernephroma. I had a chance to see a case of this sort, not quite watching it grow, but seeing it develop in a place that I had explored a couple of years before. I had operated for a chronic appendix with extensive adhesions of the cecum. The whole region was thoroughly explored and the cecum mobilized and, at that time, there was no tumor I am sure. About two years after, the patient appeared with a bunch to the right of the scar. I opened the abdomen and found a tumor growing from the cecal wall and not attached in any way to the surrounding peritoneum or other tissue. I shelled it off, did not excise that part of the cecal wall—perhaps I should have—and brought the peritoneum together; a simple, easy operation. The patient recovered perfectly and there has been no return in some years. Dr. Whitney reported hypernephroma. There was no sign of any trouble about the kidney or other organs. The patient has been perfectly well ever since.

CHOLECYSTECTOMY: UNDER WHAT CIRCUMSTANCES SHOULD IT BE DONE?

By MILES F. PORTER, M.D., F.A.C.S.
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The fearful fallacies that figures may lead to unless they be studied in connection with all related facts, is nowhere more clearly shown than in the various papers, published in late years, on the relative merits of cholecystectomy and cholecystotomy. These papers likewise show how true it is that facts are quite as fallacious as figures.

Jones, for instance, in studying a series of his cases finds that he has secured 20 per cent. more cures by cholecystectomy than by cholecystotomy, and Brown, by a like study, gets the same result, whereupon both Jones and Brown conclude that cholecystectomy is to be preferred to cholecystotomy. A comparison of Jones's figures with Brown's, however, shows that the former (Jones) gets 20 per cent. more cures in both operations than the latter (Brown). The same logic used in arriving at a decision in favor of cholecystectomy would, if based on a comparison of Jones's figures with those of Brown, lead to the conclusion that Brown should quit doing gall-bladder surgery and turn it over to Jones.

The writer felt impelled to make the foregoing remarks after a somewhat extensive study of the literature on gall-bladder and gall-duct surgery that has been published within the last decade—the results of which study are incorporated in another paper.[1] As a result of that study, coupled with a personal experience covering about 1000 cases of surgical disease of the

gall-bladder and gall ducts the following conclusions have been reached:

1. The gall-bladder in man is a very important organ though not a vital one.

2. Cholecystectomy is followed by an increase of bile-pressure within the ducts and thus enhances the danger from pancreatitis.

3. The cause of the symptoms in so-called gall-bladder disease resides only relatively infrequently in the tissues of the gall-bladder.

4. Recurrence of symptoms after cholecystotomy means, in the majority of instances, overlooked stone, reformation of stones, infection of the bile stream, or hypercholesterinemia.

Assuming that the first conclusion, *i. e.*, that the gall-bladder in man is an important organ, is concurred in, it necessarily follows that the gall-bladder should never be removed save when its removal is necessary for the cure of the disease for which the operation is done.

The object of this paper is to discuss the question, When is the removal of the gall-bladder necessary?

It is generally agreed that gall-bladders of the following types would better be removed:

1. Hydrops with obliteration of the cystic duct.
2. Calcareous or fibrous degeneration.
3. Chronic empyema.
4. The cholesterin or strawberry gall-bladder.
5. Carcinoma, provided it is limited to the gall-bladder.
6. Extensive laceration or perforation.

Many would perhaps add to this list gangrene of the gall-bladder. However, many patients with gangrene of the gall-bladder are desperately ill and will die if cholecystectomized, but will recover if a simple cholecystotomy and drainage operation is done. I have had several cases which support this position, as have Deaver and other operators. It may be said then that in cases of gangrene of the gall-bladder, cholecystectomy is the operation of choice only when it may be done without adding materially to the operative risk, and that all other cases of this

kind should be treated by simple drainage. One occasionally meets with circumscribed gangrene due to pressure of a stone accompanied by acute cholecystitis. In many such cases cholecystotomy is to be preferred to cholecystectomy.

How about the acutely infected gall-bladder with thickened edematous walls?

It is the author's experience that patients with gall-bladders of this type are practically always completely and permanently cured by cholecystotomy. In a hundred or more cases of this type I know of none that have recurrence of trouble provided at the time of operation or within a day or two thereafter there was a free flow of bile into the gall-bladder. Some of these patients were operated on twenty or more years ago and are still living and well.

Buchanan[2] states that of 212 cholecystotomized cases in which note of this fact was made he found that only 8.5 per cent. of those in which it was noted that the bile flowed freely into the gall-bladder were not entirely cured, whereas in cases in which the bile did not flow at all, 45 per cent. were not entirely cured. The prognostic importance of the flow of bile into the gall-bladder at the time of operation or shortly thereafter is at present, I think, underestimated. Attention to this point will often enable the surgeon to choose wisely as between cholecystectomy and cholecystotomy. That the gall-bladder has remarkable power of recuperation has been demonstrated many times.

Does the return of symptoms after cholecystotomy usually mean, as is held by some, that cholecystectomy should have been done?

My own experience and the study of the reported cases compel me to dissent from this view. In my own work cholecystectomy was done in 10 per cent. or less of all cases, and of this 10 per cent. there was failure to get complete cure in 2 cases, whereas in the remaining 90 per cent. there was failure of cure in 5 cases. In other words, the failures following cholecystotomy were in proportion less than half those following cholecystectomy. There is no pretense that this calculation is based upon an exact

tabulation of all cases, nor is it questioned that some failures in both types of cases have occurred without my knowledge. On the other hand, there can be no question but that in the writer's experience cholecystotomy has given a larger percentage of satisfactory results than has cholecystectomy. It goes without saying that malignant cases do not enter into this consideration.

Stanton,[3] who has presented one of the best studies of which I know on the subject of reformation of gall-stones, says, "The reported cases do not bear out the assumption that cholecystectomy affords a much greater immunity against reformation of calculi than does cholecystotomy." My own experience is in accord with this. It is self-evident that removal of the gall-bladder will not cure cholesterinemia. Cases of this type, as has been pointed out by Aoyama,[4] Gerster,[5] and Rothschild[6] are not in need of surgery at all but are to be cured by a careful attention to diet, which consists largely in using only such foods as are poor in lipoids. It should be remarked in this connection, as was done by Gerster in his article previously referred to, that the hypercholesterinemia may pass while the bile still contains a sufficient excess of cholesterin to produce symptoms, and that a persistent high cholesterin content of the blood strongly suggests common duct obstruction, especially if there are attacks of pain, and that the absence of jaundice proves nothing. It appears to the writer illogical to remove a gall-bladder in cases wherein the bile stream is infected except in those cases in which it seems clear that the infection comes from the deep structures of the gall-bladder—in interstitial cholecystitis, if you please. Rhoads[7] reports several cases which seem to show that the administration of hexamethylenetetramin has a curative affect in bile-stream infection. The average duration of drainage in 56 cases in which the drug was given was over six and a half days less than in those in which it was not given. Rhoads also reports cases with recurrence of symptoms that were cured by the administration of this drug. One of the arguments advanced in favor of cholecystectomy is that the morbidity following this

operation is less than is the morbidity following cholecystotomy. This is unquestionably true, but that it is true is in no small part due to the fact that a larger percentage of patients die and that more promptly following cholecystectomy than following cholecystotomy. With this exception the writer's experience is that the increased morbidity of cholecystotomy as compared with cholecystectomy consists in the slight inconvenience caused by the bile drainage.

With the present state of knowledge the last word on the subject of the surgery of the gall-bladder and gall ducts may not be said. However, at the present time the conclusion seems warranted that it is neither necessary nor advisable to remove the gall-bladder except when it is diseased or injured beyond the probability or possibility of restitution, and that this power of restitution may be presumed to be lost only when one or the other of the following conditions obtain:

1. Hydrops with obliteration of the cystic duct.
2. Calcareous degeneration or fibrous degeneration with contraction.
3. Chronic empyema.
4. The cholesterin or strawberry gall-bladder.
5. Carcinoma.
6. Extensive laceration or perforation.
7. Gangrene other than localized gangrene, such as is sometimes caused by pressure of a stone.

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2. Surg., Gynec. and Obst., 1915, xxi, 504.
3. Ann. Surg., 1915, lxi, 226.
4. Am. Jour. Med. Sc., 1915, p. 764.
5. Gerster: Prog. Med., June, 1916, p. 164.
6. Am. Jour. Med. Sc., 1916, p. 394.
7. Surg., Gynec. and Obst., October, 1916, p. 399.

DISCUSSION

Dr. Fred B. Lund, Boston:

This is an extremely interesting and important subject on which I have had to change my views in the last few years. I cannot entirely agree with Dr. Porter's paper. I had 3 cases of recurrence of gall-stones, where I know all were taken out, some by better surgeons than myself, and I have had 3 cases of cancer coming on in a gall-bladder after the removal of stones. A few years ago it was not safe to take out gall-bladders, but now if we make a properly long incision, as described by Judd, we can take the gall-bladder out safely and the mortality is not any greater in my hands than cholecystotomy if I limit it to the proper cases. Gall-stones usually form in the gall-bladder and go down into the common duct from there, and if you cut out the pocket in which they form you are less apt to have them form in the duct unless there has been a long-continued infection, a stone or stricture plugging the duct. If you have to use the gall-bladder for a drain in cases of pancreatitis it is better to drain than take it out; but if you do not, here is where the thing starts and you take out the source. Years ago Dr. Mixter and Dr. Lilienthal used to take out gall-bladders and were criticised for it; but now other people are doing it more and more. I would agree pretty well with what Dr. Porter said in regard to conditions where it should be removed, but where it is simple and safe we should give the benefit of doubt to the removal, rather than in simple drainage which in my own and others' hands has resulted in invalidism and cancer for the patient afterward. Drainage does not cure cholecystitis. Removal usually does.

Dr. Howard Lilienthal, New York City:

For years I have been fighting for cholecystectomy, and I am glad to say that I think most of us now believe in the operation. It is quite impossible to be sure that every stone has been removed unless the gall-bladder itself is removed. And even with cholecystectomy I had the misfortune once to perform an incomplete operation because I mistook a diverticulum of the gall-bladder for the common duct, and there was a stone in this pouch which I had to remove later. Also, it is not possible to tell the true condition of every part of the gall-bladder unless it has been removed. It is all very well to say that a strawberry gall-bladder should be extirpated but the diagnosis of strawberry gall-bladder cannot be made unless the viscus is in our hand. It is not even possible to be sure that the cystic duct is absolutely unobstructed simply because there is bile in the gall-bladder.

A method which I have employed in cases of doubt is to insert a fine hypodermic needle obliquely into the gall-bladder and draw off a little bile with a suction syringe. If the bile flows freely and is of a yellow or greenish transparent color cholecystectomy may not be necessary. But if there are granules or a large admixture of mucus so that the bile flows with difficulty or not at all and if it is of a deep, dark green color the viscus should be removed even though it appears normal otherwise.

Dr. William J. Mayo, Rochester, Minnesota:

I would like to ask Dr. Porter whether he is convinced that following cholecystostomy a gall-bladder functionates, or whether it is not altogether probable that such a gall-bladder, frozen into the abdominal wall and surrounding parts by binding adhesions, the result of a cholecystostomy, is functionless although not giving rise to trouble. We must keep clearly in mind that conservation means the saving of function, not merely the relief of symptoms. Unfortunately, our experience goes to show that cholecystostomized gall-bladders often give rise to symptoms after many years of supposed cure. Patients are coming back to us now that were operated on ten, fifteen and even twenty years ago by cholecystostomy, with late manifestations of disease in the gall-bladder. Again, we have seen a large number of cases, now more than a hundred, of papilloma of the gall-bladder often in situations in the mucous membrane not visible in a cholecystostomy, and very often there are no stones in these cases. Unless the gall-bladder is split from top to bottom strawberry ulcerations and papilloma in the pelvis of the gall-bladder and in the vicinity of the cystic duct will not be detected. The papillomatous type of cholecystitis may be considered precancerous.

For many years, for what we believed to be good cause, we removed about 40 per cent. of gall-bladders, but of late years, following the example of Lilienthal, Lund and others, we have greatly extended the application of cholecystectomy, and now remove the diseased gall-bladder at the primary operation whenever we can do so safely.

It has been shown by Rosenow that the bacteria are in the deeper layers of the mucosa of the gall-bladder and not in the bile, which may be sterile.

Dr. Joseph C. Bloodgood, Baltimore:

I have had considerable opportunity in the last five or six years to go over the records of twenty-seven years at Johns Hopkins Hospital and study them in regard to certain rules, and when I first began to go over them, say ten or eleven years ago, I was impressed

that this investigation led to certain questions which are influencing future work. In the last two or three years a reinvestigation of this material has convinced me that we should be very careful about using conclusions, say of surgery of the breast twenty to twenty-five years ago, and have it absolutely an influence without exception with regard to the surgery of the future. I have just been over cancer of the breast, and our experience in the last two years, if it had been influenced by our experience of the first twenty-five years, would have shown no progress. There is no question about these careful statistical studies of past work, but if it should influence our future work is a question, and Dr. Lund hit the nail on the head when he said he had changed his mind. The surgery of the first twenty years was dealing with a terminal disease, but fortunately the surgery of today and of the future will be surgery of disease in its infancy. Here is one point that I want to give in regard to cancer of the gall-bladder. Up until five years ago we had 60 cases of cancer of the gall-bladder which represented about 10 per cent. of all cases in which we had careful records, and these 60 cases died. We did not save a single case. Most of them were inoperable, and a few that were operable died later. Now if in the next group of say 600 cases in the future we find that there are only 2 per cent. of deaths from carcinoma of the gall-bladder—something has happened. If we cure, say 10 per cent., one will say they have not been cancer when operated on, but if we reduce in the future by early intervention the percentage of cancer of the gall-bladder from 10 per cent. to 2 per cent., something has certainly happened. It is difficult to recognize operable cancer of the gall-bladder. I think it will be more difficult to recognize it with the microscope. I cannot get any agreement among pathologists between the differential diagnosis, say, of hypertrophy of Lushka's glands and early carcinoma. In our experience in the past, 10 per cent. have been cancer and incurable. Can we cure this 10 per cent. by drainage or cholecystectomy? I cannot conceive from this view that it will be drainage. The surgery of the gall-bladder today, so far as removal of the gall-bladder goes, is a much simpler procedure than in the past. I will tell you frankly that up to two years ago in studying these cases I came to the conclusion that cholecystectomy was contra-indicated except in a small proportion of cases, and yet when we came down to the facts of cholecystectomy I have done more in the last two years than in the past twenty years.

Dr. Alexis V. Moschcowitz, New York City:

I have no doubt that the question of decision between cholecystectomy and cholecystotomy has now swung back, according to the

usual and well-recognized pendulum action. I would like to add, however, just one word, and I believe I speak for Dr. Gerster, Dr. Lilienthal and myself, who operate at Mt. Sinai Hospital; namely, that since we have learned the benefits of a cholecystectomy, we have stuck to the operation, and have never had occasion to abandon it. After a cholecystectomy the convalescence is uneventful, shorter and better; the patients are as a rule discharged in twelve to fourteen days, and have no occasion to come back to us for further treatment.

Dr. Arthur A. Law, Minneapolis:

It is a very trite saying that the dripping of water will wear away stone. I want to make my contribution to the ultimate impression on this stone. For nine years in the University Clinic the younger men were confused by the swinging of this pendulum and had no definite line of attack. Finally, we had to work out our own salvation in this matter. We had 4 cases of cholecystotomy which impressed me by the secondary delivery of a stone through a fistula, and my colleagues poked fun at me. Since then in the University of Minnesota Clinic we have drained but 3 cases of gall-bladder, for I have taken them all out. It is difficult to decide which gall-bladder should be taken out. If you catheterize the mucosa of the gall-bladder you can get cultures of bacteria and these show which organisms have the greater specificity.

Dr. John B. Deaver, Philadelphia:

I can only say a word, that most of my time is occupied taking out gall-bladders that other men have left in. I have had a few I have left in myself in previous years. I think the crux of the situation has been taken up at the Mayo Clinic as just stated by Dr. Law. I try to impress on students that the importance of gall-stone disease is not the effect on the gall-bladder alone, but the results in the shape of pancreatic and lymphatic involvement. Many cases of pancreatic lymphangitis are due to the failure to remove gall-bladders, and we know without a doubt that the pancreatic lymphatics can be infected through the gall-bladder and second portion of the duodenum, and my belief is that all infections of the gall-bladder and duodenum lead on to disease of the pancreas, and that condition cannot always be cured, consequently I rarely leave a gall-bladder, and my mortality is less than when I did more cholecystotomies.

Dr. Miles F. Porter, Fort Wayne, Ind. (closing):

From the discussion of this paper up to this point one would get the idea that the gall-bladder is a useless organ. The fact is, that

according to our laboratory friends the bile has a very important digestive function to perform; this function is due to the glycocholate and taurocholate of soda which it contains; these salts the bile gets largely during and because of its residence in the gall-bladder. As shown in the paper, anatomical, physiological, and clinical facts all point to the conclusion that the gall-bladder in man is an important though not a vital organ. This being granted, it follows that the gall-bladder should not be removed without cause. There is ample evidence to prove that removal of the gall-bladder does not prevent formation of gall-stones. Dr. Lund in his remarks cited a case in which he said he had done cholecystostomy and that he knew that there were no stones left behind. If Dr. Lund can invariably tell when he has removed all of the stones during a cholecystostomy, all I have to say is, that he is a better surgeon than I. Many of our most experienced operators tell us that unless they open the common duct they find that they leave gall-stones behind in from 20 to 40 per cent. of their cases. Further in his remarks, Dr. Lund asks, "How do you know you have a strawberry gall-bladder?" In reply I would say that for the average surgeon it is much easier to tell when he looks on the inside of the gall-bladder whether he is dealing with a strawberry gall-bladder or not, than it is for him to tell when he has removed all of the stones from the gall tract. My clinical experience over a period of more than twenty years has proved to me that the gall-bladder has wonderful recuperating powers. During this time I have opened the common duct several times for the removal of stones which had formed after a cholecystectomy. The fact is, that what we want is to arrive at the truth, and I believe that this swinging of the pendulum which is so much deplored by Dr. Moschcowitz will greatly aid in this realization. I will conclude by saying that there is overwhelming evidence to prove that the gall-bladder in man is an important organ and that this fact must not be lost sight of in surgical attacks upon it.

EPIGASTRIC HERNIA WITHOUT PALPABLE SWELLING

By ALEXIS V. MOSCHCOWITZ, M.D.
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In a previous communication upon the subject entitled "The Pathogenesis of Hernia of the Linea Alba," I believe I[1] have proved quite conclusively, that by far the largest number of these herniæ are not herniæ in the true sense of the word. From time immemorial the term "hernia" has come to mean a protrusion of a peritoneal sac; this is so generally acknowledged that we look upon the presence of a hernial sac as an essential requirement of all herniæ. In epigastric hernia, however, a peritoneal sac is of exceptional rarity. I have not examined my statistics regarding this point, but I am safe in stating that not more than one case in twenty has a true hernial sac. Even in the cases which do have a hernial sac the sac is only a secondary acquisition and is found only after the hernia has attained a sufficient magnitude to pull out a peritoneal diverticulum. In the paper already quoted I have also demonstrated that in most of the cases the bulk of the protruded mass is not, as is commonly assumed, composed of omentum, but is merely a prolongation of the fat enclosed between the two peritoneal layers forming the falciform ligament of the liver. The commonest form of epigastric hernia is sacless, and one in which the peritoneum is not involved in the least.

Epigastric hernia differs from all other herniæ also in a further important attribute, namely, that it has a very distinct symptom-complex. By far the greatest majority of uncomplicated herniæ in other parts of the body are symptomless. On the

other hand, I have found the symptomatology of epigastric hernia to be so constant that its absence in a doubtful case would be sufficient to exclude the diagnosis of such a hernia. It is true that the symptoms of an epigastric hernia are little known and quite vague, still they are fairly characteristic. The patients usually complain of eructations, nausea, and periodic attacks of pain, which they localize into the entire epigastrium. These complaints are not unlike those we are accustomed to see in ulcers of the stomach or duodenum, with the difference, however, that they do not bear such a constant relation to the ingestion of food. I do not intend to discuss in detail the differential diagnosis between epigastric hernia and gastric ulcer. I merely wish to point out that the symptomatology of an epigastric hernia, no matter how large or how small, has a striking similarity to that of a gastric ulcer.

As for the physical examination we find in epigastric hernia first of all a mass situated at or near the median line of the abdomen, some place between the umbilicus and the xiphoid appendix. The smaller herniæ appear to be situated directly in the median line; in their subsequent growth, however, they usually extend away from the median line, usually toward the left side.

The hernial protrusion varies greatly in size; in the majority of the cases the mass is very small, rarely larger than a marble. In some cases the hernia is very small, sometimes not larger than a pea or a lentil, in consequence of which, and more particularly in the obese, it is very difficult to palpate. Occasionally all that is discoverable, either on inspection or upon the gentlest palpation, is a very slight elevation in the midline of the abdomen. I have found that the best way to practice inspection in these small herniæ is to stand at the head of the patient and then to examine the linea alba in not too brilliant illumination, so as to note the slightest differences. The palpation in these cases is best practised with the aid of a single finger.

Irreducibility of the mass is a very frequent characteristic of epigastric hernia.

I am now coming to an unappreciated and yet absolutely constant physical sign of epigastric hernia, namely, that no matter what the symptoms caused by the hernia; no matter what the size of the hernia; no matter whether reducible or not; no matter whether the patient is of the phlegmatic or hysterical type, the hernial protrusion itself, and more particularly the ring or opening through which it makes its escape into the subcutaneous tissues, is always very tender. This is so characteristic that in the very smallest herniæ, *i. e.*, those which cannot be palpated with an absolute certainty, the diagnosis of an epigastric hernia can and should be made by finding such an extremely tender point in the midline of the abdomen. All cases giving a history resembling vaguely that of a gastric ulcer should be examined for a small epigastric hernia; this examination is materially aided by finding a tender point in the midline of the abdomen. Difficulty arises only in such cases in which there appears to be a combination of the two maladies, namely, an epigastric hernia complicated with a gastric ulcer; but even in these a differential diagnosis ought to be made with comparative ease. The tenderness in gastric ulcer is not as superficial nor as sharply circumscribed as in epigastric herniæ. The cause of the pain in cases of epigastric hernia is still a moot point. The early writers upon the subject (Garengeot, Pipelet, etc.) were of the opinion that the gastric distress complained of by these patients was due to the fact that the stomach formed the most frequent hernial content. Subsequent writers accepted this statement of Garengeot tacitly. Only within comparatively recent years was the frequently assumed presence of the stomach as a hernial content disproved. I believe that the pain is merely a referred pain and is caused by a dragging upon the falciform ligament of the liver.

So far as I know the tenderness in the protruded fat and also in the hernial ring has never before been described. As already stated, I have not failed to find it in a single instance; it is very surprising to me that it should have escaped attention until now. It is such a constant symptom that its explanation ought

to be very easy. Unfortunately it is not, and I confess that thus far I am still undecided as to the reasons for the tenderness. There are several possibilities. I am now investigating this point, but my investigations are not yet sufficiently advanced to permit me to speak authoritatively. When these investigations have been completed I shall be glad to report upon them.

In view of the uncertainties regarding the causative factor of the pain and of the tenderness in epigastric herniæ I wish to call attention to a symptom-complex resembling that of the commonly accepted epigastric herniæ in every respect, and yet there was not even an indication of a hernia present.

My observations are based upon 2 cases only. I shall therefore give their histories with some detail. Both cases were referred to me by Dr. Seymour Basch, and I avail myself of this opportunity to express my appreciation for the careful preoperative observation and the notes of the cases.

Case I.—Mrs. J. M., aged thirty years. Patient was operated upon three years ago for a chronic appendicitis after two attacks of a rather acute character. At the operation many adhesions of the omentum were found. Previous to the operation the patient suffered also from frequent attacks of nausea, which she relieved by inducing vomiting. Since five years the patient also complains of peculiar attacks of sneezing, which occur irrespective of time and place; on awaking in the morning she would sneeze a number of times in succession, followed by a discharge of a watery fluid from the nose, however, without the sensation of nasal obstruction. Patient had had all kinds of local and general treatment, but entirely without any success.

Extirpation of the appendix had no influence whatsoever upon her previous complaints. The nausea and vomiting promptly recurred. Patient married shortly after operation. During the first six months of the ensuing pregnancy patient vomited so much that she was unable to retain anything. In spite of this, however, she felt too well to remain in bed for any length of time.

Patient is decidedly of the phlegmatic type. Skin and mucous membranes rather pale. Examination of the heart, lungs, and central nervous system is negative. The urine shows no abnormalities. No goiter is present, and there are no enlarged lymphatic glands. The abdomen was slightly pendulous. The right kidney is slightly ptosed and the greater curvature of the stomach appears to be at the level of the umbilicus. One and a half inches above the umbilicus, in the linea alba, there is a small and persistent point of tenderness; patient winces with pain when pressure is exerted upon this point; this point is localizable with an absolute precision; it was also impossible to elicit another similar point throughout the entire abdominal examination. Not even the slightest indication of a mass, such as a small epigastric hernia would give, is to be felt. This point of tenderness and its exact location and invariability was verified upon a number of subsequent occasions.

Examination of the stomach contents one hour after an Ewald test breakfast showed 58 total acidity and 36 free HCl; no gross or microscopic abnormalities. The thread test was negative. X-ray examination of the stomach and intestines was also negative.

Had a physical examination of this patient revealed even the slightest indication of a swelling at the point of tenderness in the midline of the abdomen its presence taken in conjunction with the history would have induced me to make the diagnosis of an epigastric hernia without the slightest hesitation. In the absence of such a swelling, however, I refrained from making any diagnosis at first. On subsequent examinations I finally decided to operate upon the presumptive diagnosis that an impalpable hernia existed.

Operation March 17, 1915. The dissection was carried out with the greatest care in order not to destroy the evidence of our findings. One and a half inches above the umbilicus, in the linea alba, exactly at the point of the persistent tenderness, there was encountered a good-sized vessel surrounded by a delicate fascia, which escaped through a transverse elliptical open-

ing in the linea alba. No trace of a fat protrusion was seen. The vessel was ligated and the part distal to the ligature cut away. The proximal stump was pushed back into the hole and the latter closed with one Pagenstecher suture. Patient made an uneventful recovery.

January 1, 1917, I heard from Dr. S. Basch that her recovery was startlingly rapid and the result persistently good. Patient lives out of town, but reports to me from time to time. She has gone through another pregnancy since the operation, and absolutely without any trouble.

Case II.—Miss D. J. R., aged twenty years, single, was also referred to me by Dr. Basch. At the age of five months patient had whooping-cough, which lasted an entire year, and was accompanied by a great deal of retching and vomiting. Four years ago patient was operated upon in a neighboring city for appendicitis. Patient suffered from habitual constipation for practically her entire life, in consequence of which she is compelled to continually take laxatives.

For many years patient has been suffering from recurring attacks of nausea in the morning, which usually occur on arising and disappear spontaneously in the course of the forenoon; occasionally the nausea is so severe that patient also vomits. These attacks of nausea are increasing in frequency, so that hardly a day passes by without an attack. They were absent for a very short while only after the operation for appendicitis.

Physical examination is negative except for the following: There is a definite circumscribed point of tenderness in the linea alba two and a half inches above the umbilicus. This point of tenderness is found upon repeated examinations and at various intervals. No other point of tenderness is elicited anywhere upon the abdomen.

Examination of the stomach contents one hour after an Ewald-Boas test meal showed a total acidity of 72 and free HCl 42; microscopic examination was negative.

She was treated at first symptomatically with appropriate

diet, rest, and abdominal bandage, and the internal administration of validol, however, without any relief.

In the absence of any definite physical signs I was at first averse to suggest an operation. But having in mind the excellent results obtained in the practically similar Case I, I suggested the consideration of an operation. This was done July 24, 1916. The linea alba was exposed through the longitudinal incision, and at the point exactly two and a half inches above the umbilicus a vessel was seen emerging from the linea alba through a small transversely oval opening. The vessel was ligated between two ligatures, the proximal stump pushed back and the opening closed.

After operation, patient at first perfectly well, again suffered from time to time with nausea, but finally this disappeared completely, and now, ten months after operation, she feels perfectly well.

To recapitulate in brief the salient points of these two cases, they were the following:

1. The symptoms were remotely suggestive of those of an ulcer of the stomach and therefore also those of the well-observed cases of epigastric hernia.

2. The principal physical sign was a localized area of tenderness, of the size of a lead-pencil in the midline of the abdomen, between the umbilicus and the xiphoid appendix.

3. The complete absence of a true hernia of the linea alba, and also the absence of the merest indication of one, as might be represented by a small lipomatous outgrowth contiguous with the fat contained in the falciform ligament of the liver.

4. The sole finding at the operation was the bloodvessel normally present, which pierced the linea alba exactly at the previously outlined area of tenderness. The opening in the linea alba was perhaps larger than is normal.

5. A cure and complete relief of all the symptoms by simple ligation of the vessel, pushing back of the proximal stump, and closure of the opening.

I have searched the literature most carefully, but I have

failed to find a single similar case. Singularly, however, I found an article by Mohr,[2] with practically the same title as I have given to this article, namely "Ueber Hernia Epigastrica ohne fühlbare Geschwulst," in which the author gives a short history of 2 cases which he had observed; he also quotes other authors as having seen similar cases.

Mohr's cases are immensely interesting and I will be pardoned therefore if I abstract same.

Case I.—Male, aged forty years, who has been suffering for years with digestive disturbances, namely, irregular, occasionally extremely severe, colic-like attacks of pain in the upper abdomen. He was treated for a very long time by internal medication, and about two years before coming under Mohr's care had been operated upon by another surgeon, he was told, for a median (epigastric) hernia; the operation, however, brought the patient no relief from the symptoms, which returned promptly after patient left his bed. Fifteen months later patient was again operated upon by another surgeon for the cure of a ventral hernia in the cicatrix of the previous operation. After this operation the attacks disappeared for six weeks, but then recurred in their old severity. Mohr saw the patient eight months after the second operation, and at his examination found that the patient was greatly emaciated and apparently suffering greatly. In the linea alba above the umbilicus there is to be seen a well-healed cicatrix of the previous operation, without any trace of a ventral hernia. Two finger-breadths above the upper end of the incision, and exactly in the midline of the abdomen, there is a sharply circumscribed localized point of tenderness, which is so small that it can be covered by the tip of a finger; everything else is negative. On repeated examinations this point of tenderness was never found to vary; the vicinity of this point and the cicatrix of the previous operation were not in the least tender. Patient insists that his pains originate in this tender point. He was operated upon by Mohr, who found, behind the old cicatrix, extensive adhesions between it and the linea alba, colon, and omentum. Above the cicatrix the parietal peri-

toneum was free from adhesions, only a long-drawn-out piece of omentum was adherent between the stomach and the tender point; a hernia *sensu strictu* was not present. The adherent tip of omentum was ligated and liberated. Primary union. Patient was absolutely free from pain from the date of operation, and this freedom continued up to the time of publication (five months).

Epicrisis. It is perfectly possible that Mohr dealt with just such a case as I have reported, but judging merely by his description one must naturally arrive at the conclusion that the case is by no means proven. It is true that no hernia was seen; in fact, nothing was seen that would remind one even remotely of one; all that was seen was a mass of adhesions, originating from the two previous operations, and a bit of omentum adherent in the midline of the abdomen. All of which may be sufficient to explain the symptoms, but is not sufficient to entitle the author to publish the case as one of epigastric hernia without any palpable tumor.

CASE II.—This case was also a male, aged thirty-four years, with an anamnesis and symptoms similar to Case I. Physical examination shows exactly in the midline of the abdomen three finger-breadths above the umbilicus a constant, sharply circumscribed point of tenderness. Patient suffered so much that an exploratory operation was advised. Incision of the abdominal wall down to the transversalis fascia failed to show signs of a hernia; only when this fascia was incised, at the previously described point of tenderness, a lump of fatty tissue popped out. As this was pulled upon the peritoneum tore, and it was then seen that the fat was the end of a bit of omentum which ran to the stomach and the free end of which escaped through the hiatus in the linea alba and then became incarcerated. This portion of the omentum was ligated and replaced in the abdomen. Patient is free from pain since the operation. A few months later he again suffered from an attack of abdominal colic, but Mohr believes that it had nothing to do with his

previous operations. At the time of publication (four years) patient is still free from all trouble.

Epicrisis. The case is not absolutely acceptable as one of epigastric hernia without palpable swelling for the following reasons. The description is not quite clear. That fat protruded when the transversalis fascia opposite the tender point was incised is no criterion, because this is found to occur wherever the falciform ligament is attached. Furthermore, the case was complicated by an intra-abdominal pathological condition, which in itself may have been the cause of the symptoms and not the hernia.

Mohr quotes from the literature, so to say, in fortification of his stand-point, the following cases, which on analysis, however, are not *bona fide* cases of epigastric hernia without palpable swelling.

Kuttner[3] gives an excellent resumé of the subject of epigastric hernia, particularly as it bears upon the gastric symptoms. He also emphasizes the fact that even sacless epigastric herniæ, *i. e.*, such composed only of a subserous lipoma, give similar symptoms, but he does not mention epigastric herniæ without any swelling. His smallest case was evidently the size of a lentil, but even this was palpated perfectly before operation.

Mohr next quotes Linniger,[4] but this author reports no case as belonging in this group; he merely says that occasionally the smallest epigastric herniæ give rise to the severest symptoms. Thus one hernia the size of a pea gives rise to such severe symptoms that patient was prevented from taking sufficient nourishment.

Temoin[5] records a most interesting case of vomiting which had existed for over one year and which defied all internal medication. Absolutely nothing was found on examination, so far as inspection and palpation was concerned, except a point of extreme tenderness between the umbilicus and xiphoid appendix, pressure upon which brought on an attack of vomiting. Temoin advised an operation, and on very careful dissection he found in the median line a small omental hernia, which was

twice as large as the head of a pin, and which it was naturally impossible to discover by palpation. It had no sac and was directly contiguous with the omentum (?). Resection and closing of the wound was followed by complete recovery.

Epicrisis. This case is perhaps nearer than any other one to my cases. The hernia was certainly very small, exceedingly small, but still fat was present, a fact which differentiates it from my cases. I do not wish to speak of the other erroneous observations of the case, such as continuation with the omentum.

Wittgenstein and Grosse[6] give an excellent resumé of the subject, but quote no case.

Metzger[7] reports a case which is so interesting that a verbatim translation is justified. The patient was a male, aged forty years, who complained of pain in the stomach, and in whom a hyperacidity was found. Metzger found in the linea alba above the umbilicus a very tender point, and as no benefit whatsoever was obtained from medicinal and dietetic treatment, he referred the patient to the surgical clinic in Tübingen for operation; no hernia was found, nevertheless the patient was completely cured by the operation.

Metzger says that most probably the case was one of those small slit-like openings in the fascia, which was cured by the suturing of the divided fascia.

Epicrisis. This case resembles in many details the two reported by me. It is regretable, however, that the author did not operate the case in person, and that the report is therefore second hand, so to speak.

It is perfectly possible that the two observations I have made in the 2 cases I reported are well known, and therefore hardly worth while placing on record. However, I have, as already stated, failed to find any reference whatsoever to such cases in the literature. Mohr's cases can hardly be said to be true cases of epigastric hernia without palpable swelling, because they were complicated by intraperitoneal adhesions, etc. The cases he refers to, to fortify his stand, were at best very small herniæ.

The choice of the title of this article, "Epigastric Hernia

without Palpable Swelling," is not entirely satisfactory to me, because I have not brought forward any valid proof that the symptoms in these cases were due to an epigastric hernia. There are to my mind only three possibilities to explain the symptoms and their relief by operation. The fat protrusion may have been so small as to escape attention. I do not believe this, because both cases were operated upon with the most punctilious care in order not to destroy any evidence of a protrusion. It is reasonably possible that the fat protrusion may have been present, but that it was absent during the operation, while the patient was anesthetized; this does not appear to me to be probable, because I believe that the protrusion would have become evident in the course of the operation. I purposely pulled upon the vessel to render any temporarily reduced fat protrusion visible, but I failed to do so. A third possibility is that it was an epigastric hernia, in which the fat protrusion had not yet escaped beyond the linea alba; that is, that it was, so to say, an interstitial form of an epigastric hernia. I look upon this explanation as very probably the true one, and I base my opinion upon the following facts: (1) the symptomatology which is absolutely identical with that of a complete epigastric hernia; (2) upon the identical pathology; (3) also upon the perfect cure, which ensued upon simple ligation and division of the vessel, and closure of the opening through which it escaped.

I believe the subject is of some importance, particularly on account of its close resemblance to gastric ulcer. I hope my observations will be verified.

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DISCUSSION

Dr. Arthur D. Bevan, Chicago:

I should like to say one word in regard to Dr. Moschcowitz's paper, and that is, as to the cause of the symptoms in these epigastric herniæ. It is a subject about which I have thought a good deal and have arrived at a conclusion by making a comparison between this and similar forms of hernia. We have been studying with a good deal of care the general problem as to the gas pains and the intra-abdominal disturbances that follow promptly after operation for hernia. When we used a general anesthetic for these cases we thought that this gas pain and abdominal disturbance was due to the anesthetic, then when we used local anesthesia in a large group of cases without ameliorating the condition we came to the conclusion that we had been mistaken in regard to this matter. We looked for the definite cause of these gas pains and intra-abdominal disturbances after hernia and arrived at this conclusion which seems to be the most probable explanation of these conditions, and that is, the pinching of the peritoneum in the sac. With the greatest possible care in a number of cases we made these operations without any discomfort to the patient in a perfectly clean, reducible hernia and after it had no symptoms of any kind, except these intra-abdominal symptoms and gas pains. When we operate on these cases, you all know that under local anesthesia, when the sac is ligated it is very sensitive. To my mind that is the explanation of the symptoms in a hernia of the linea alba; you have a little transverse slip in the linea alba through which some of the soft, peritoneal fat is pushed and drags after it a little peritoneum, and with the pinching of that peritoneum you have the causation of the symptoms. These symptoms are often regarded as being due to some duodenal or gastric condition. I think undoubtedly what Dr. Moschcowitz has done in his simple operation is that he has relieved that pinching of the small piece of peritoneum that is dragged out with the subperitoneal fat.

Dr. Stanley Stillman, San Francisco:

Some fifteen or eighteen years ago Dr. Hirschfelder kept finding cases of epilepsy which he attributed to small epigastric herniæ. It was a fad at that time, and in consequence I had a number of cases to operate on in young people for him. I must have had 8 or 10 cases, and in every one of these on which I operated I searched most conscientiously for the hernial sac but failed to find the peritoneum at all. As Dr. Moschcowitz says, they were little protrusions of fat.

They were irreducible, small, hemispherical, tender masses. So far as I can recollect none of the cases were benefited so far as the symptoms of epilepsy were concerned. So far as Dr. Bevan's explanation is concerned, it does not seem reasonable that the symptoms were due to pinching of the peritoneum, as I never found the peritoneum in any of these cases.

Dr. William B. Coley, New York City:

Dr. Moschcowitz says that in his cases he acknowledges no tumor. In our cases at the Hospital for the Ruptured and Crippled, in 5600 operations we have had 30 cases of epigastric hernia. In nearly all cases by careful examination we have made out a tumor, but it is very difficult. On having the patient cough you can usually feel something push against the little opening. In addition to this little cleft, not always in the median line, we find usually a little protrusion outside, not always, except on coughing, which goes down and is mostly fat. And inside of this fat is found a little protrusion of peritoneum which is attached to, and projects through, the fascia and gives rise to the severe pain. Our treatment of these cases is not merely closing the cleft but making a wider opening, finding the fat and doing an overlapping operation of the fascia. We have had no recurrence in these cases and some have been under observation for over twenty years.

Dr. Howard Lilienthal, New York City:

Dr. Moschcowitz has surely contributed something new to this subject. Whatever is the cause of the pain, I have observed that these little epigastric herniæ do give rise to sensations of a most disturbing character. The feeling usually disappears when the patients lie down. We may learn more about this subject by operating in local anesthesia taking care, however, not to anesthetize the pedicle itself.

Dr. August F. Jonas, Omaha:

Possibly we can account for the pain in these cases by the fact that we have all observed in opening the abdomen in cases not completely anesthetized an intense reflex of the musculature of the abdominal wall when we touch the parietal peritoneum, which is extremely sensitive. This was worked out by Lenander, who pointed out the fact that there is an extensive network of sensory nerves in the parietal peritoneum which is not the case in the peritoneum covering the intestines. When we take hold of a gall-bladder it is entirely free from pain. When we attach the fundus of the gall-bladder to the parietal peritoneum, and when we open the gall-bladder a week later, it is

done without pain and without reflex. When we have pain in connection with gall-bladder disease it is located in the cystic duct where the nerve distribution is very extensive. In these epigastric herniæ the pain can be accounted for by the fact that there is an irritation at the margin of the opening where the mass protrudes through it and beyond it, and irritates the parietal peritoneum which has an extensive nerve supply.

Dr. Willy Meyer, New York City:

The majority of us, I am sure, have been taught that the protrusion in the linea alba above the umbilicus, which we call epigastric hernia, represented protruding omentum. Dr. Moschcowitz has rendered a great service in carefully going into this matter and proving that it is in most instances a protrusion of the ligamentum teres of the liver, with its fat. Since I have read his interesting article I have paid particular attention to this question and could make out exactly what he has said in 3 cases. By means of a transverse incision we found the arterial vessel which he describes. After its ligation it was easy to reduce the protruding fat and then close the rent in the fascia. Only in 1 case I did not find the artery. Lately a male patient with a large and tender epigastric hernia came under my care. I expected to find a sac with abdominal contents, and so operated under a general anesthetic. Ordinarily these cases can and should be operated under a local anesthetic. I found that the tender protruding mass was made up of inflamed fat which was changed in its color; I believe it was a strangulated epigastric hernia. The pathologist pronounced the removed mass a portion of edematous fat. Here I could not reduce the remaining tissues through the fascial opening. I therefore elongated the slit, viz., made a typical, transverse superficial incision. Then it was very easy to push the mass back and close the hole with two interrupted sutures. The patient made an easy recovery.

Dr. Howard A. Lothrop, Boston:

I became interested in this subject twelve or fifteen years ago and looked it up pretty carefully. My attention was first called to this condition by the internists who quite often found a little swelling here. At that time I came across two excellent German articles which I think brought out most of the points Dr. Moschcowitz has illustrated. At that time I got all the cases I could, say about twenty, which I operated on, and also obtained specimens in the dissecting rooms of the Harvard Medical School where there were a good many fatty tumors. At the start there is simply this hypertrophied fat,

but as it goes on a lot of these develop into true herniæ. I had one where there was a well-developed hernia containing strangulated small intestine, the size of a fist. I have seen 6 cases where the small intestine complicated the hernia. I believe many other varieties of hernia develop, as do the epigastric variety, from this action of the properitoneal fat.

Dr. Alexis V. Moschcowitz, New York City (in closing):

I am very much afraid that the point which I raised in my paper was absolutely missed. I did not speak at all of epigastric hernia; I considered that settled, and I spoke entirely about "Epigastric Hernia without Palpable Swelling;" a subject apparently unknown. As, however, epigastric hernia in general has been discussed, I shall have to reply to some of the statements made regarding that subject also. I do not agree entirely with Dr. Coley, and I differ in at least one important point with Dr. Bevan. The cross-section of the anterior abdominal wall as drawn by Dr. Bevan is not absolutely correct, as he has neglected to draw the falciform ligament of the liver, and it is the fat contained within the two layers of this ligament which forms the main bulk of the hernial protrusion. It is on this account also that Dr. Coley's drawing is faulty, because the hernial sac (if any is present) is usually to one side of the hernial protrusion, and not in its center. But all this is beside the mark. My paper today deals only with cases with the symptomatology of an epigastric hernia, but without the physical signs of one.

PARAFFIN HERNIA: HERNIA COMPLICATED BY PARAFFIN INJECTIONS

By AUGUST FREDERICK JONAS, M.D.
OMAHA, NEBRASKA

The title for this communication is open to criticism, for it does not strictly comply with the usual definition of hernia. If we insist that only those defects answer to the name of hernia which consist of "a protrusion of any viscus through an adventitious opening in the wall of the cavity which contains it," we can hardly reconcile it with the designation of paraffin hernia. For it has been shown that only occasionally is injected paraffin found within the hernial sac, and then it does not protrude through an adventitious opening, and it is not a part of the anatomy of the carrier. It has found its lodgment from without and not from within and is an extraneous foreign substance. But we will use the term for our convenience to describe a series of cases where paraffin was used with the intent to cure hernia. These findings have been described inaccurately as paraffinoma. We really have herniæ complicated by paraffin.

Since Gersuny introduced paraffin for prosthetic purposes, the method has been employed for a series of widely differing surgical defects. Undulating nasal backs, sunken cicatrices, claimed the early attention of operators; later followed efforts to maintain prolapsed uteri and descended rectal termini, and urinary incontinence was said to be controlled by it. Cleft-palate received due attention, facial blemishes that were existent and those that still remained in expectancy became the monopoly of the beauty doctor. In the course of time the herniologist, after he had found wanting and had discarded the local injection of alcohol, tannic

acid solution, chloride of zinc and many other curatives, and the application of his inefficient but marvelously constructed trusses that were credited with magical power had failed, pounced upon paraffin as the all-saving and never-failing cure-all for herniæ of all descriptions. Gersuny had informed the surgical world that paraffin when injected subcutaneously set at once, and became a smooth, easily molded, unchanging, painless, and unirritating support. It was not long before some fertile-minded genius bethought himself of making a stopper for the inguinal canal to prevent the spilling of an intestinal coil and he believed it could be modelled into any shape that the requirements of the operator suggested. Our specialist then claimed the field for his endeavors, and when he announced himself as prepared successfully to do this work without knife or pain and no detention from business, he certainly had come into his own, for he still flourishes beyond all measure. His few devotees extol his achievements and his many dupes are eloquent in their silence. His promising advertisements still maintain a long waiting list.

It may interest us to consider some personal observations on the end-results of a few personally observed cases of hernia that had subjected themselves to paraffin injections.

It has been the writer's privilege to have operated and removed the paraffin in ten of these cases, in all of whom the hernia still persisted. All of them applied for treatment because the hernia continued to be uncured, and in every one the pain and discomfort had become continually more severe and in several instances unbearable.

It seems that the object aimed at in the paraffin injection method is to create a plug in or at the inguinal canal which is designed to create a stopper or cork to retain the hernial loop in its normal location, very much like the cork in a bottle. Theoretically such expectation might, in a measure, be expected if the cork were always accurately applied and filled the inguinal canal completely from external to internal ring, preventing the descent of an intestinal loop into any part of the canal. It is not clear whether the intention has been to inject the paraffin

into the hernial sac, filling that portion constituting its neck, or whether the paraffin is to be introduced external to the sac to compress its neck so as to prevent an intestinal descent.

Whatever may have been the intent of the originators of the procedure, the practical workings have been uncertain. The widely differing relations of the injected paraffin to the inguinal canal, as shown by the cases here reported, indicate either the impossibility of an accurate control of the injection or an ignorance of anatomy of the inguinal canal and the nature of hernia on the part of the operator, or both.

When one takes into account the impossibility of ascertaining clinically the exact size of the hernial sac, whether it can be pushed back with the reduced hernial loop or whether it extends partly or completely into the scrotum, or whether there exist omental adhesions, whether the sac wall is thin or thick, whether the canal is long or short and in some cases whether hernia is direct or indirect, it becomes clear that no matter how accurate the knowledge of anatomy or however skilful may be the planting of the paraffin, the method must be inaccurate, and if successful in placing the injected mass so that it will hold the hernia, is as much of an accident as its promiscuous distribution in, around and beyond the actual defects as found in the average case.

When we recall the endless varying conditions found at an open operation and the impossibility of determining in advance of an exposure of the parts the altered anatomical landmarks, it becomes clear that any treatment that is administered by the subcutaneous method lacks all essentials of accuracy and its technical uncertainties should condemn it.

In all of the cases to be herein detailed there were no two cases in which the paraffin occupied the same anatomical structures, nor was there any uniformity as to the quantity deposited. In the greater number of cases the injected material was found outside of the hernial sac and the inguinal canal. In one case the paraffin mass was larger than an ordinary fist and it extended from the pubic tuberculum to the anterior iliac spine. In another it was deposited in several masses about but outside of the external

ring and extending down along the descending pubic ramus of the urethra. In one instance the hernial sac was almost filled with a mass the size of a hen's egg; it extended nearly to the internal ring like a cork; but it was not sufficient to retain the hernia—a hernial loop had slipped down beside it. In another case the paraffin was so small in amount that only a small, flat, fibrous nodule, outside of and attached to the cord, remained.

In a number of cases several injections had been made at different sittings, as many as seven injections in one case, because the hernia recurred after each treatment. In several instances the paraffin was found outward and above, and in several below the inguinal canal without effect for better or worse in the defect except to produce pain which had not existed before.

We naturally ask ourselves, What becomes of the injected paraffin? Gersuny and others insisted that it remained unchanged in the tissue. That is apparently true in many instances, but not invariably so. In referring to our own cases several masses had been injected into the loose areolar tissues in the groin, and particularly in obese subjects, the masses were round and had smooth surfaces; they were easily shelled out; there were absolutely no connective-tissue attachments. The cavities, from which the nodules were removed, were smooth. No attempts had been made to create limiting membranes of connective tissue. In the older cases, where the masses had been made more than two years previously, the limiting membranes were distinct. In one case two distinct masses of paraffin, one anterior and one posterior to the cord, had been injected eight years previously and remained unchanged.

The masses found within the hernial sac were unchanged. There was no noticeable change in the endothelial lining of the sac except at the point where the needle had entered; at that point there was a distinct fibrous attachment, its fibers entering the paraffin itself.

At points where the paraffin had been deposited in dense tissue like the fascias and in the inguinal canal external to the sac, the masses were adhered by a development of connective tissue

which penetrated the paraffin. This was particularly true of the smaller masses, and in one instance, where the original mass probably was no larger than an almond, the entire mass was permeated with connective tissue, breaking up the paraffin into innumerable small globules. In one case, aside from a nodule that had been injected near the internal ring, a part of the paraffin was deposited accidentally intradermally and immediately beneath the papillary layer, creating a reddened indurated area. A microscopic examination of this dermal nodule showed an invasion of connective tissue, breaking the mass into numberless small globules, suggesting an attempt at final absorption.

How long may paraffin remain in the tissues before absorption, if such occurs, is complete? This question may be illustrated by an experience not connected with hernia, but by a case that had been a carrier of paraffin that had been injected four years previously:

A middle-aged, attractive woman had been persuaded by a beauty doctor that he could endow her with perpetual youthful facial beauty if he would be permitted to inject paraffin at points in her face usually occupied by wrinkles which were the forerunners of senile manifestations. She readily consented. Masses of paraffin were deposited above and between the brows, the outer corners of both eyes and the angles of the mouth and in the nasal folds, and, to complete the cosmetic work, several globules were injected to improve the nasal contour. All the injections were subcutaneous. For a short period following the treatment there were no visible changes. In about three months reddened areas developed over all the injected points. These areas became more pronounced, increased in extent so that the face finally presented the appearance of an extreme chronic alcoholic.

When she presented herself for consultation, which was more than four years after the treatment, she exhibited extremely reddened and distorted features with prominent nodules at all injected points. Her nose was especially large and swollen like that of the proverbial coachman.

She desired to have the paraffin removed. It was finally decided to excise it with a scalpel. Every nodule was firmly attached to and was permeated by connective tissue; they were dissected out with difficulty. The pathologist's report by Dr. O. S. Schultz was as follows:

Considering the duration of the inflammatory process set up by the action of the injected paraffin, the lesion is striking in the absence of differentiated fibrous tissue and of newly formed bloodvessels. In spite of the latter factor, necrosis is absent, peripherally, as well as farther in; the inflammatory tissue has the same subacute, proliferative character, and there has been no peripheral walling-off by fibrous tissue. The injected paraffin is absent in the prepared sections (it was probably dissolved out in the staining process), but there can be no question but that the spaces present, and they were numerous, in the tissues represent the situations of the paraffin. The latter, since it is not removable, must act continuously as an inflammatory irritant. The character of the tissue reaction indicates that it acts as an irritant of low grade of intensity. Where the paraffin was present in larger amounts it appears to have caused hyaline degeneration and atrophy of the stroma rather than proliferation.

While the paraffin is not soluble and cannot be completely removed, it apparently can be broken up by the proliferating tissues, as the small size of the vacuoles in the more cellular tissues and the vacuoles present within the giant cells would indicate. In order that fragmentation of the paraffin could occur, the injected paraffin must have had a low melting-point which rendered it soft at body temperature. The prolonged and continuous inflammatory reaction set up in this case shows that paraffin injected into the tissues cannot be considered an entirely inert and innocuous substance.

In studying our cases it was found that the least change took place when the paraffin was deposited in loose connective tissues. Moderate changes in form of connective-tissue invasion occurred when it was deposited in dense structures. If deposited intradurally about the inguinal canal or intradermally it infiltrated

the tissues and became a source of irritation, setting up a prolonged and continuous inflammatory process. When the mass was deposited in loose areolar tissues there was no apparent inflammatory reaction except for the formation of a limiting connective-tissue wall. The paraffin masses remained unchanged. The amounts injected varied greatly. The smallest amount was not less than one dram and the largest quantity weighed sixteen ounces.

This brief discussion is based on a report of the following cases, ten in number, which were operated by the writer for the removal of the injected paraffin with an intention to cure herniæ.

CASE I.—A. B., merchant, weight 225 pounds, aged forty years, entered my service at the Methodist Episcopal Hospital suffering with urinary retention due to organic stricture situated in the prostatic urethra. Forcible catheterization previous to admission had produced traumatisms leading to perineal urinary and sanguineous infiltrations. A sound could be passed only to the prostate. Six months earlier he had been subjected to paraffin infiltrations for the cure of a large right-sided inguinal hernia. In spite of a thick layer of adipose tissue on the abdomen and in the groin, a hard mass the size of a goose egg could be palpated over the external inguinal ring and another extending downward into the scrotum and smaller masses in the perineum. A suprapubic puncture to relieve urinary retention had been attempted without success. The urgency for the relief from the distress of an overdistended bladder was great. A suprapubic cystotomy, under ether, was done shortly after admission. The bladder being opened and emptied of a large amount of urine, a block-tin sound was passed into the upper urethral end down to the prostatic obstruction. A median perineal incision was made dividing the cicatricial structures down to the point of the sound. The tissues involved in the stricture were divided so that the tip of the sound could be pushed through the perineal wound. A mass of paraffin about the size of an English walnut firmly embedded in the tissues and lying to the right side of the urethra anterior to the prostatic urethra was removed. This mass extended upward

and was connected with the paraffin near the external inguinal canal. A rubber tube was introduced, protruding from both suprapubic and perineal wounds creating a through-and-through drainage. The day following his operation he had completely recovered from the conditions of shock which existed when he entered the hospital, but he complained of pain in the right groin at the site of the paraffin mass. He had had a free bowel movement during the night and, since no intestinal protrusion in the right groin could be felt, it was hoped that the local pain was due to paraffin irritation. The pain became less in the course of a week.

On the tenth day there was a sudden enlargement of the mass in the groin accompanied by intense pain. It was apparent that an intestinal loop had descended beside the paraffin, resulting in incarceration. An immediate operation confirmed this conclusion. An incision through the thick layers of fat disclosed a hard goose-egg-sized mass over the external inguinal canal. Other rounded nodules were felt, one extending upward along the groin to the extent of four inches. A second one, ovoid in shape, extended downward to the perineum. A third one extended into the obturator foramen, a fourth mass pointed along the surface of the horizontal pubic ramus. All normal anatomical lines were obliterated. Each mass was firmly attached to the tissues and was dissected out with difficulty. After their removal the spermatic cord was found to be infiltrated so that it presented itself like a section of hard rawhide cord. The hernial sac wall was stiff and hard, as if it contained paraffin, but none was found in its interior. A mass at the external ring had compressed the circulation in the intestinal loop within the sac so as to obstruct its circulation, giving the appearance of a strangulation. The hernia was closed by the imbrication method. The entire mass of paraffin removed exceeded the size of a double fist and weighed sixteen ounces. A great deal of paraffin remained infiltrated in the tissues which could not be removed.

Case II.—G. L., aged forty years, a stock dealer. One evening the writer was summoned in haste with instructions to bring a

complete operating outfit to operate a strangulated hernia on a man at his own home. His condition seemed to forbid his being moved to a hospital.

On arriving at the bedside, a strangulated right-sided inguinal hernia, complicated by a large mass of paraffin which had been injected more than a year previously, was found. The patient was in great pain, had an almost uncountable pulse, rapid, shallow respirations; in every way he seemed *in extremis*. Hasty preparations for an immediate operation were made. Under a rapid light ether anesthesia the operation was begun. The usual incision revealed a large flattened mass of paraffin, which extended upward from the external inguinal canal to the extent of four inches and outward along the inguinal canal to a distance of five inches. Three hen's-egg-sized paraffin nodules were embedded below Poupart's ligament in Scarpa's triangle; another a walnut-sized nodule about two inches below the external ring and between this and the first-named mass could be felt; the hernial sac was tensely distended and almost black in color. All these masses were intimately and firmly attached to the surrounding connective tissue. A most tedious dissection followed. All normal anatomical lines were obliterated. Finally, all the paraffin was removed. The sac was opened; it contained a black intestinal loop which still retained its gloss. It was returned into the abdominal cavity. The hernial canal was repaired with tier sutures by the usual imbrication method. Recovery uneventful.

Case III.—J. S. M., aged twenty-five years, admitted to my service at the Methodist Episcopal Hospital. He was suffering from an irreducible left-sided inguinal hernia. A hard hen's-egg-sized mass could be palpated overlying the external inguinal canal. The patient volunteered the information that he had undergone the paraffin treatment eight months ago. Under ether anesthesia, and through an incision, an ovoid mass of paraffin, the size of a large hen's egg, was easily shelled out, leaving a distinct coating of paraffin in the walls of its bed and

extending into the hernial canal and infiltrating the spermatic cord. The inguinal canal was large enough to permit the passage of an intestinal loop. The pressure from the paraffin interfered with the return circulation and effectually prevented a reduction of the hernia. After dividing the fascia of the external oblique up to and above the internal ring, the hernial sac was opened; the intestinal loop was intensely congested but retained its gloss. It was reduced. The closure of the canal was with chromic gut sutures. Recovery was uneventful.

Case IV.—J. G., railroad brakeman, aged thirty-five years. More than a year prior to admission he had undergone the paraffin treatment, but his hernia had recurred and it had become very painful.

On examination there were found in his left groin three hard spherical masses. Two of these were the size of English walnuts located below Poupart's ligament, and a third, the size of an ordinary lemon, was firmly attached to the fascia of the external oblique at a point between the external and internal inguinal rings, exerting only enough pressure on the inguinal canal to interfere with a return of the protruding intestinal loop. This mass was only loosely attached to the subcutaneous tissues but firmly adhered to the oblique fascia. The two smaller masses were only loosely attached and were easily removed. The usual radical operation completed the operation (Ferguson-Lucas-Championnière). Recovery smooth.

Case V.—C. F., aged twenty-five years, farmer. Right-sided oblique inguinal hernia treated with paraffin eighteen months prior to his visit to the writer. An examination revealed a hen's-egg-sized, irreducible, fluctuating swelling at the right external ring. Cough and strain produced a distinct impulse. Over that swelling and to its outer side, nearly within external ring, existed a hard, rounded, circumscribed, walnut-sized mass. It was not freely movable. It appeared firmly attached to the muscular fascia. It appeared that the hernia reappeared soon after the treatment, although several paraffin injections were given. At first reduction could be effected by palpation, but for

a year past the hernia could not be reduced. Much pain and discomfort gradually developed.

Operation. The usual inguinal incision disclosed both hernial sac and paraffin mass at the same time. The paraffin being more prominent was removed. It was firmly attached to the external oblique fascia by connective tissue evidently penetrating the mass. The loose areolar connective tissue had become closely attached to the paraffin so that the mass was dissected out. The mass was pressing on the outer side of the inguinal canal so as to materially reduce its lumen and seemed to interfere with reduction.

In the hernial sac there was a small amount of paraffin which was attached by connective-tissue filaments to the intestinal and sac walls. The paraffin was easily detached, leaving a small area of defective intestinal serosa which was infolded with several sutures before the loop was returned. The usual radical herniotomy terminated the operation.

Case VI.—I. O. D., farmer, aged twenty years, appeared at the usual afternoon consultation hour. He stated that nearly two years previously he had received one paraffin injection for the cure of a right inguinal hernia. The injection had been made without any previous preparatory treatment except that the hernia was reduced. The operator used a syringe consisting of a metal barrel that would hold about two ounces. To it was attached a long needle. This was plunged through the skin without the slightest attempt to disinfect it. A small amount was forced into the region over the external canal. In twenty minutes he was pronounced cured. The fee having been paid in advance, he was politely invited to retire.

An examination revealed a small, ill-defined hard mass no larger than an almond over the external canal; a hernial loop was lying below it. Reduction was effected with difficulty.

Operation. An incision laid bare a hard almond-sized mass that dipped into the inguinal canal to about one-half its length. The canal was laid open and the mass was dissected out. It appeared like a fibrous neoplasm and not until it was sectioned

could the existence of paraffin be determined. Connective tissue had penetrated throughout the mass. The paraffin had been broken up into minute particles which were confined in small cellular spaces. No paraffin was found in the hernial sac. The usual radical herniotomy followed.

Case VII.—J. D., aged forty years, mechanic. Presented himself at the afternoon consultation hour. He stated that he had been treated eighteen months previously with paraffin injections for the cure of a right-sided inguinal hernia. On examination a large, hard, oblong mass, beginning at the pubic tubercle and extending outward to the iliac spine, was found. The individual was rather corpulent. The paraffin mass appeared to be in rather loose adipose tissue. There was much pain in the inguinal canal, but a loop of intestine could not be felt because it was overlaid by the paraffin.

Operation. Under ether anesthesia a long incision extending from the anterosuperior iliac spine to the pubic tubercle was required to expose the large mass of paraffin. None of it had entered the inguinal canal. It was spread over the external ring, permitting the descent of an intestinal coil. The entire mass of paraffin after its removal weighed eleven ounces and was introduced at five different sittings. The mass was found in several large compartments with no adhesions except at the internal ring where connective tissue had evidently penetrated the mass. The usual herniotomy (Ferguson imbrication) was done. Recovery prompt.

Case VIII.—M. D. S., aged twenty-one years, brakeman, came to the Methodist Episcopal Hospital. He stated that he had undergone the paraffin treatment for hernia nearly two years previously. He was not certain whether his hernia was cured on account of the swelling due to the paraffin. He stated that he had almost constant local pain. Examination disclosed a rather flat, round, hard, oblong mass twice the size of a silver dollar. It was located intradermally and immediately beneath the papillary layer in the subcutaneous connective tissue. It was not

attached to the deeper structures. Beneath it could be felt a protruding intestinal loop.

Operation. The skin incision passed through the hard mass. It was found that the entire mass was permeated with connective tissue; the paraffin could not be separated, but it was necessary to excise the skin and all like a neoplasm. No paraffin was found in the inguinal canal. A radical herniotomy concluded the operation.

CASE IX.—T. B., aged twenty-four years, farmer, presented himself with three rounded, walnut-sized masses in the right inguinal margin. One mass rested slightly above another to the outer margin and the third below the external inguinal canal and, posterior to all of these masses, protruded an intestinal loop which was painful and tender to touch. It receded with recumbency. About fifteen months previously three injections of paraffin had been made, all at the same sitting.

Operation. The usual incision exposed three paraffin nodules enclosed in fairly circumscribed connective-tissue enclosures. They had formed no cellular attachments and were easily lifted out of their beds. None of these lumps had exerted the least pressure on the external ring or any part of the inguinal canal, nor was there a particle of paraffin in the inguinal canal. The shots had missed the target entirely. The usual radical herniotomy concluded the operation. Recovery uneventful.

CASE X.—J. L., real estate dealer, aged forty years, came to the Methodist Episcopal Hospital to be operated for a right-sided inguinal hernia which had been unsuccessfully treated with paraffin. He stated that eight years previously he had received two injections of paraffin. Only a short time afterward he felt a recurrence. He could plainly feel an intestinal loop in the scrotum when he assumed the upright position, and it usually disappeared when he lay down. But occasionally it was reduced with difficulty.

On admission a hard mass the size of a hen's egg could be palpated in the right groin immediately internal to and beneath the external ring. Behind this mass a reducible swelling was

palpable. An incision revealed an ovoid smooth paraffin mass which was easily removed. Another mass could be felt behind the cord. This mass was oblong, nearly three inches long, and nearly one inch in diameter. It occupied a cavity with smooth walls and was easily taken out. The hernial sac and the cord passed between the two masses. There were no adhesions in the sac. The operation was finished by the Ferguson-Championnière method. Recovery per primam.

One cannot but wonder why the paraffin method for the treatment of hernia has survived. The foregoing cases would seem to demonstrate the inefficiency of the procedure. One can easily see the reasons for failure in the cases where injections had been made regardless of the anatomy and underlying conditions which constitute a hernia. But in several of our cases the masses had been introduced at least partly in the inguinal canal and partly into the sac itself, and yet recurrences occurred. The reason for this is found partly in the fact that the inguinal sac was not completely obliterated and partly in the fact that the attenuated internal oblique muscle and the conjoined tendon were in no way reinforced or affected by the extraneous substance. Since it is impossible to determine the exact structural defects in any hernia without their exposure by incision, it follows that it is impossible to know where to deposit the paraffin and how much is necessary to reënforce the weakened tissues. It would seem that a so-called cure rested on a lucky chance. It is probable that cases of incomplete hernia with a short sac may be benefited by paraffin introduced into the inguinal canal producing its compression, but certainly no obliteration. Some of these so-called cures are deceptive, as was shown by two cases who consulted the writer for other conditions. In both of these cases the individuals believed themselves to be cured. In both the paraffin masses were conspicuous under the skin and easily palpable by the patients, but they were unable to feel the intestinal loops beneath the paraffin nodules that could easily be palpated by the surgeon. Both of these individuals had been enthusiastic in their praise

of the method and were the means of inducing many others to try the procedure. It would be instructive to examine a large number of these alleged cures to ascertain how many of them were carrying obscured herniæ. It is more than probable that many of them are converted into concealed ruptures discoverable only by those trained and skilled in the diagnosis of these conditions.

DISCUSSION

Dr. Emmet Rixford, San Francisco:

The question has arisen as to the length of time that paraffin may remain unchanged in the tissue.

Several years ago (1909) I operated for the repair of a perineum which presented the usual picture of the complete laceration. Cutting into the tissues about the ends of the sphincter there exuded two or three drams of soft paraffin which lay in a channel about the anus with a definite wall. The patient told me that the paraffin had been injected by Dr. Paul Mundé, of New York, twenty-five years before in a final effort to secure continence after several futile attempts had been made to unite the ends of the anal sphincter. The paraffin was of the consistency of pomade. It is remarkable that the paraffin should have remained all those years in such a situation without giving rise to any noticeable irritation.

Dr. Alexis V. Moschcowitz, New York City:

I dislike to disagree with Dr. Jonas, but it appears to me that the title of his paper is not absolutely correct. Dr. Jonas discusses in this paper cases in which paraffin has been used, so to say, for the cure of a hernia. On the other hand, the term "paraffin hernia" in medical literature, means cases in which paraffin has been injected in order to simulate a hernia. I have seen and operated a number of such cases. They are met with exclusively in Russian immigrants, in whom the paraffin is injected in order to circumvent military conscription.

Dr. Arpad G. Gerster, New York City:

It is principally the cosmetic interest I wish to refer to in bringing up the following case. I did not have an opportunity to see the case myself, but heard about it from a reliable practitioner of New York. It was said that paraffin is used in the case of prostitutes to reinforce or improve the vulva so as to imitate virginal conditions. True plastic surgery of the introitus vaginæ for this purpose was known from ancient times, and is still practised by certain Eastern civilized nations and by various savage tribes of Africa. It is therefore not to be wondered at, that the cosmetic employment of paraffin injections should have extended to this region also.

Dr. Stanley Stillman, San Francisco:

As Dr. Jonas has brought up the subject of the use of paraffin for cosmetic effect I will just say that I think I can now, although it is a year since I saw the patients, get two or three people who are willing to pay from twenty-five hundred to five thousand dollars to be restored to the condition they were in before the paraffin was used. We have

all encountered the cases described by Dr. Jonas but there is one point in connection with what he says that I would like to mention. He speaks of the absorption of the paraffin and suggests the possibility of it and speaks of the infiltration of the paraffin by connective tissue. To me these paraffinomata are identical in their formation with hematomata. The liquid paraffin separates the meshes of the areolar tissue and when it hardens contains a perfect network of connective-tissue fibers. The paraffin infiltrates the connective tissue instead of the connective tissue infiltrating the paraffin later, as Dr. Jonas suggests. Any attempt at removal by a curette is about as satisfactory as the same procedure would be for the relief of a recent black eye. I have never seen any cases in which there had been any attempt at absorption, and I do not think there is any possibility of it. The masses remain in place indefinitely and I know of one case which was rather amusing, in which exposure to the hot California sun in an automobile ride resulted in the paraffin gravitating down into the jowls of the patient from the cheeks, where it had been injected to secure plumpness several years previously. The result was most ludicrous, but the woman was almost insane in consequence.

Dr. August F. Jonas, Omaha (in closing):

I was unable to read my paper in its entirety and therefore some of the important points were of necessity left out. In answer to Dr. Stillman's question, I did not state that paraffin would ever become entirely absorbed, but that in small masses in tissues that were dense the infiltration of tissue from every side suggested the efforts at disintegration, but not that there was absorption. Whether it ever becomes absorbed I do not know. My oldest case was of eight years' duration and a mass as large as a hen's egg remained undiminished. The interesting thing has been that all of these cases seemed to be cured: In depositing the mass of paraffin on the outside of the inguinal canal it covered up the hernia so that one could not feel it, and that the patient certainly could not feel it, is quite certain. Some patients say there had been no return of the hernia after the paraffin treatment, but on examination in the standing position an intestinal loop could be felt behind the paraffin wall itself. So I question whether many are really cured. I think they are converted from palpable to obscure herniæ. I only mentioned facial blemishes incidentally to show what might become of the paraffin. I thought of doing animal experiments to see what really did become of the paraffin in the animal. This patient proved to be a ready-made experiment for me in showing what really might become of the paraffin. It was very difficult to excise these solid masses, they became finally embedded in the connective tissue.

EMPYEMA OF THE THORAX

By HOWARD LILIENTHAL, M.D., F.A.C.S.
NEW YORK

REPORT OF ONE HUNDRED CASES TREATED IN THE SURGICAL SERVICE OF THE WRITER AT MT. SINAI HOSPITAL

Before this Association, in 1915, the writer presented a paper describing his method of procedure in empyema of the thorax.

The keynote of the surgical treatment was full and complete exploration through a widely spread, long intercostal incision without resection of the ribs. In this paper it was distinctly stated that while standing for the principle of free exploration, this operation might be performed as a second stage following the relief of cyanosis, dyspnea, or other threatening symptoms of intrathoracic pressure by a minor intercostal incision with tube drainage. It is to be clearly understood that while no single procedure is suitable in all cases, our aim must be to secure a final result with no impairment of chest capacity.

Having now had the opportunity of observing 100 cases treated in my service at Mt. Sinai Hospital, from March 25, 1914, to March 25, 1917, a period of three years, the time is considered ripe for reporting this experience and the conclusions which have been reached.[1]

[1] Since the report in 1915 two papers on this subject have emanated from this service, the first by Lilienthal and Ware, "Recent Progress in the Operative Treatment of Empyema of the Thorax," Med. Record, July 15, 1915; second, The Trend of Surgery in Empyema of the Thorax," by Martin W. Ware, Ann. Surg., March, 1917.

To begin at the end, I may say at once that with increasing familiarity the treatment of this condition as previously outlined has impressed itself more and more favorably upon me.[1] Moreover, other surgeons who have been present at these operations have expressed themselves as convinced, and a number of them have adopted the method.

All patients suffering from empyema of the thorax and not previously treated surgically were operated upon regardless of the prognosis and regardless of the source of the pus.[2] No patient was refused because he was believed to be moribund, and this can be well illustrated by noting that one death occurred before the anesthetic was administered and before the incision had been made, the end coming during the preparation on the operating table. This case, naturally, is not included in our list because no operation was performed. One patient with pyemia, perforated metastatic lung abscess, and suppurating osteomyelitis of the bones about the knee-joint died following an amputation of the thigh. This case is counted in our list. Two fatal cases of pyemic abscesses of the liver with perforation into the chest are also counted. One case of tuberculosis of the lung with perforating bronchiectasis still further swells our mortality rate, and all of these cases fall under the group of those which were operated upon by the procedure which I have taken the liberty of denominating major intercostal thoracotomy.

Deducting these, instead of 100 cases with 23 deaths we would have 95 cases with 18 deaths, or 18.9 per cent. mortality instead of the 23 per cent. which my table shows—for I am not in sympathy with the sport of juggling statistics.

It will be noted that the 100 patients whose cases we tabulate represent 38 minor thoracotomies with 18.4 per cent. mortality; 44 major thoracotomies, many of them preceded by minor

[1] The operations in the 100 cases were performed by the writer, by Dr. Joseph Wiener, and Dr. Martin W. Ware. A few cases were operated on by the house surgeon under supervision.

[2] Those operated upon elsewhere and coming to us with thoracic wounds are not referred to in this paper.

thoracotomy, with a death-rate of 27.2 per cent.[1] Resection of the ribs with their periosteum and gauze packing in encapsulated empyema treated as if it were abscess, 7 cases with no deaths. Resection and drainage by the old method, 7 cases with 1 death, or 16.6 per cent. This is in reality one form of minor thoracotomy.

The 100 patients were divided between children and adults, 64 under twelve years of age and 36 over twelve years old.

Male patients predominated over females at the rate of about 2 to 1, or in the last two years 25 females to 51 males.

Counting, as we have, all cases of empyema primarily operated upon and counting the deaths, no matter from what cause, the mortality shows a 5 per cent. improvement over the ten years with 299 patients reported recently from all the surgical services at Mt. Sinai Hospital.[2] The patients who recovered remained in the hospital an average of about thirty-seven days, a gain of one week over past records.

But now we come to a matter of the greatest importance where a most striking improvement is demonstrated. In former years collapsing thoracoplasties were performed in a large percentage of cases, probably at a moderate estimate in the neighborhood of 15 per cent. During the period covered by my table, in all the cases operated on in my service at Mt. Sinai Hospital, without the slightest attempt at selection, *there has not been a single thoracoplastic collapse operation.* There have been a number of revisions, secondary and even tertiary, but eventually all the patients referred to in the attached table not in the mortality list went home with symmetrical chests and fully expanded lungs. I believe that if nothing else had been accomplished by the work of the past three years this alone would entitle it to respectful consideration.

We have not taken unnecessary risk in selecting major thoracotomy as the method of choice. Whenever a patient's condition

[1] This extraordinary mortality does not represent the dangers of major thoracotomy for the reasons just given.

[2] Wilensky: Surg., Gynec. and Obst., May, 1915.

on admission to the hospital was considered critical the relief of minor thoracotomy was given, and in a few days to two or three weeks later, if it became evident that something more had to be done, the radical operation was undertaken.

In the past two years one-third of our major thoracotomy cases were performed in two stages.

FIG. 1.—Case I. G. W. Pneumonia diagnosed as empyema and punctured for diagnosis by another physician. Note the small localized pneumothorax in the right lower chest, resulting from the admission of air probably through the needle. Patient recovered without operation.

We try to avoid exploratory puncture of the thorax until just before the operation, depending on the clinical history, the physical signs, and above all on the *x*-ray plate in making the provisional diagnosis.

Also, during convalescence, repeated observation with the aid of the *x*-rays, especially with stereoscopic plates, often determined the necessity for further operation. Indeed, no method sur-

passes roentgenography in deciding the form of treatment during the progress of the empyema; but roentgenography, valuable as it is, must be carefully checked up with the interpretation of clinical phenomena.

X-ray examination has occasionally been the means of preventing operation when the needle has drawn pus from the chest.

Case I.—George W., a boy, aged eleven years, was admitted with a history of pneumonia and continued fever long after the crisis should have occurred. The needle, inserted by a physician not connected with the hospital, had withdrawn pus, and the case came to me for operation. The physical signs might have been taken for those of pyothorax but the roentgenogram indicated consolidation (Fig. 1). In spite of the temperature of 104°, the cyanosis and distress, we delayed on the evidence of the *x*-ray alone, and we were rewarded by a well-marked crisis within twenty hours, the temperature reaching normal and convalescence proceeding uneventfully. The pus may have been a few drops of cellular fluid in the pleural sac or it may have been exudate from the lung itself.

Case II.—Bella G., a young woman, with septic manifestations accompanied by tremendous oscillations of temperature, with pain and swelling of the larger articulations and with signs of fluid in the right chest, was seen by me in consultation. I was told that a few cubic centimeters of pus had been obtained by aspiration of the right chest. The *x*-ray picture made subsequently showed no evidence of fluid in the thorax, and I advised against operation. A few days later I was informed that pus had been aspirated from the left chest as well. The patient was taken to the operating-room and I withdrew about 2 c.c. of pus from the right side. The respiration, however, was not embarrassed, as I thought it should have been in the presence of empyema in both thoracic cavities, and I did not operate but ordered a second *x*-ray, which, like the first, failed to show the expected opacity. At the present writing, three months after the first diagnosis of empyema, the thorax is perfectly clear and

the respirations are normal, though the septic manifestations continue in spite of a general improvement.[1]

Case III.—J. L., the patient, was a child, aged three years, the son of a physician. He was referred to me by Dr. Koplik, with the suspicion of empyema following pneumonia. The radiogram disclosed a shadow limited to the left lower lobe (Fig. 2) and on the strength of this I deferred aspiration. A few days

Fig. 2.—Left lower lobe suppurative pneumonia. No empyema was present, though needle drew pus.

later, the septic temperature continuing and the child's father being importunate, I inserted a needle and withdrew a few drops of thick pus. The chest was then opened in local anesthesia and the lower lobe found indurated, dusky in color, and adherent to the chest wall, the free pleural cavity containing

[1] The patient made a final recovery.

no fluid and appearing uninfected. Two abscesses, each containing about 5 c.c. of thick pus, were evacuated after being located in the lower pulmonary lobe, with the needle through the wound and under the guidance of sight. The cavities were packed, the wound drained, and the patient recovered. This case is by no means unique, though it is rare.

These three histories are here recorded not as cases of empyema but merely to illustrate methods of eliminative diagnosis.

There were 3 cases of double empyema. All the patients were critically ill and all were young male children. There were 2 recoveries and 1 death. The 2 patients who recovered were B. K., aged three and a third years, and S. B., aged two and three-fourth years. In one the chests were opened by minor thoracotomy two days apart, and in the other by minor thoracotomy eighteen days apart. The fatal case was that of H. K., aged four and one-half years old. Here both chests were opened simultaneously on May 2, 1916. June 13 it became necessary to resect the seventh and eighth ribs on the left side for drainage. He died septic four days later.

Minor thoracotomy in these young children is a mere puncture in local anesthesia, often performed by inserting a trocar and cannula through a tiny skin incision, withdrawing the trocar and threading a tube through the cannula, which, being in turn removed, leaves the tube draining the chest. The outer end is left long and with a suitable connection is led down beneath the surface of a weak lysol solution in a vessel beside the bed.

The operation of major intercostal thoracotomy has been fully described and illustrated, so a repetition here is unnecessary. It is rarely accompanied by important bleeding, and postoperative shock has thus far been easily combated by means of morphin or codein. We have had but one death within twenty-four hours after the operation, an old man who was almost moribund at the time of the thoracotomy, and who developed hemiplegia a few hours later.

The writer believes that many surgeons have been deterred from giving this method a trial because it requires a rib-spreading retractor, and during the past two and a half years it has been

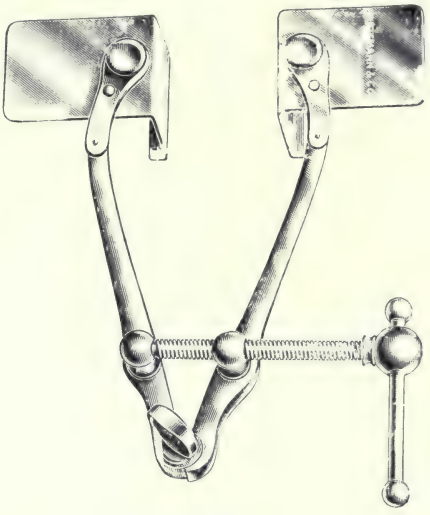

FIG. 3.—Author's rib-spreading retractor.

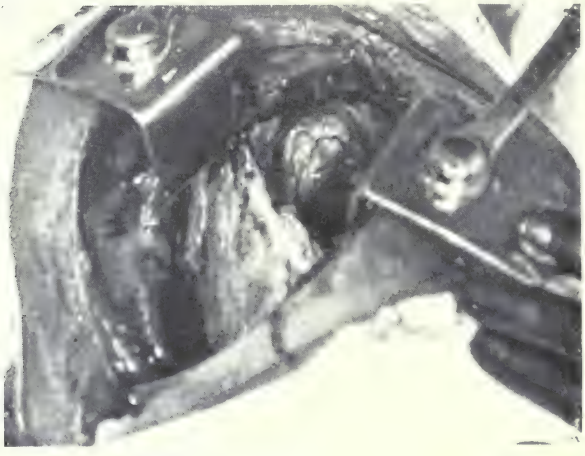

FIG 4.—Rib spreader in place. The light-colored mass in the lower left part of the incision is the contracted lower lobe covered by exudate. The mass in the depths toward the upper left part of the wound is the upper pulmonary lobe which is only a little contracted.

impossible to secure this instrument on account of the war. And it is true that without a powerful rib retractor the operation of intercostal major thoracotomy cannot be correctly done. As

FIG. 5.—Removing lymph coagulum with forceps.

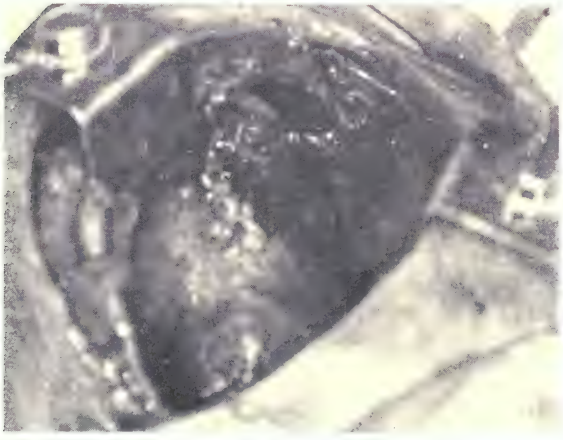

FIG. 6.—Note expansion of lower lobe by comparing with Figs. 4 and 5.

soon as it becomes necessary to make section of the ribs in order to gain the room for thorough exploration the operation increases in danger and the postoperative troubles multiply. Of all the

foreign rib spreaders that of De Quervain is the simplest and best, but even this well-made instrument is subject to annoying disorders of mechanism. Also, the blades are large for work in the case of children. The writer therefore has devised a simple retractor (Fig. 3) which is fully as powerful as any, while its tendency to get out of order is reduced to the minimum. There are large and small blades which are interchangeable, and the instrument can be quickly and easily taken apart. It is manufactured by Tiemann.

[After the reading of this paper the operation of major intercostal thoracotomy with lung mobilization was illustrated by a motion picture. This picture also showed the patient eleven days after operation. He was able to walk about and move his arms freely. Figs. 4, 5 and 6 are taken from this film by permission of the Clinical Film Co., Inc., who hold the copyright.]

	Number.	Dead.	Ages of those who died.	Per cent. mortality	Total.	Mortality rate.
Minor thoracotomy:						
Children	31	6	$\frac{1}{3}$, $1\frac{1}{2}$, 2, 3 4, $4\frac{1}{2}$	19.3	38	18.4
Adults	7	1	62	14.3		
Major thoracotomy:						
Children	21	4	$\frac{1}{3}$, 2, $3\frac{1}{2}$, 4	19.0	44	27.2
Adults	23	8	16, 24, 25, 35, 40, 43, 52, 55	34.7		
Resection for encapsulated empyema:						
Children	6	0	..	0	7	0
Adults	1	0	..	0		
Resection and drainage, old method (minor thoracotomy):						
Children	6	1	$1\frac{1}{2}$			
Adults	1	0				
Miscellaneous:						
Children	0	0				
Adults	4	3	25, 27, 33			

Total number of cases of empyema of all varieties which were operated upon primarily in Dr. Lilienthal's service in Mt. Sinai Hospital March 25, 1914, to March 25, 1917, regardless of the source of the intrapleural pus	100
Total number of deaths from whatever cause	23
Percentage of mortality	23
Children under twelve years	64
Adults	36

DISCUSSION

Dr. Willy Meyer, New York City:

There is in my mind not the slightest doubt that this operation means a great advance in our treatment for empyema. However, I cannot speak from personal experience. So far I have never operated in this way. We do our operations for empyema under regional and local anesthesia, make a good-sized resection of the rib and remove carefully all the collections of coagulated fibrin. Then, after a comparatively short drainage with tubes, we start in using the old method of after-treatment with James's bottles. It is intermittent, pronounced, positive pressure, nothing else. The patients are made to blow and expand the lung themselves. If this treatment is carried out faithfully the majority of patients make a good recovery.

Dr. Lilienthal has started the ball rolling, making a valuable addition to our methods of treatment, and succeeding in reducing the mortality rate in these cases. Personally, I never thought that the operation for empyema had such a high rate of mortality in its wake. However, I expect to pay stricter attention to this question. If the empyema has been in existence for some time Dr. Lilienthal's procedure seems to be the method of choice. But the ordinary case of one to two or three weeks' duration does very well by treatment with the old method.

THE CARREL METHOD OF TREATING WOUNDS

By C. L. GIBSON, M.D.
NEW YORK

THE great value of the Carrel method was impressed on me last year when I visited Carrel at his hospital in Compiegne and subsequently saw it carried out in the Allies' Franco-British Hospital at Annel, in charge of Dr. H. H. M. Lyle, Surgeon to St. Luke's Hospital, New York City, and at La Panne, Belgium, at the Ambulance of our esteemed honorary member, Professor Depage of Brussels. I have put the method into practice in my service at the New York Hospital in the past seven months, aided by a nurse who was trained by Dr. Carrel and by an interne who was given special opportunities by Professor Depage to familiarize himself with the details of the method.

It is believed improbable that many institutions are properly equipped to take full advantage of the value of the method, as it is absolutely necessary to know thoroughly both the theory and the practical application of all the details. Dr. Lyle was situated only four miles away from Carrel and had frequent opportunities to familiarize himself with the practice of Carrel's hospital. Professor Depage sent some of his assistants and nurses to work with Carrel, and also spent some time there himself.

The Carrel method of combating infection can be described as a series of steps which may be divided into three phases.

1. The proper treatment of a wound (*a*) to put it into the best possible position to heal secundum artem, and (*b*) to adapt it to the employment of a suitable antiseptic.

2. The use of an antiseptic which will destroy the bacteria and neutralize the toxins without injuring the tissues or diminish the normal process of repair. The antiseptic which has been found to conform to these requirements is the Dakin solution of sodium hypochlorite.

3. The conversion of open wounds when sterilized by the above means into wounds which can and do heal in a manner similar to ordinary operative incisions after proper preparation and suture.

The popular conception of the Carrel method is the employment of a solution of sodium hypochlorite which generally will not conform to the requirements of the Dakin solution and applying it to wounds indiscriminately with little and generally no knowledge of the factors necessary to success or the drawbacks or dangers.

If the Carrel method is put into practice imperfectly poor results must follow and the method will fall into disrepute and its great value become lamentably obscured. While there is nothing mysterious or difficult in the method it does require intelligent application of each and every detail which its author worked out step by step and for which he has a definite reason backed by scientific investigation.

The importance of this metriculous care was demonstrated when the principal operator of Carrel's hospital was detached and replaced by a surgeon equally experienced and competent but unfamiliar with the method. Notwithstanding the continuity of the rest of the personnel Carrel told me that it took about a month for the later arrival to become familar with the factors necessary to complete success.

The practical applications of the Carrel method have been well described in articles by Dr. H. H. M. Lyle and Dr. William O'Neill Sherman,[1] which I recommend strongly to the attention of all those interested in the subject. I shall, therefore, more

[1] Disinfection of War Wounds by the Carrel Method, Jour. Am. Med. Assn., January 13, 1917. Carrel Method of Wound Sterilization, Its Use in Military, Industrial and Civil Practice, Surg., Gynec. and Obst., March, 1917.

particularly take up some of the theories on which the method was worked out. These are lucidly explained in the recentbook of Carrel and Dehelly "Le Traitément des Plaies Infectées," and I will give an epitomized translation of the principles as outlined by them in the following pages.

The choice of a substance best fitted to sterilize an infected wound depends, in addition to its germicidal qualities, upon numerous other factors such as its irritating character, toxic power, solubility, capacity for penetration of the tissues, its absorption by the tissues and its reaction with the proteins and other constituents of the tissues. The destruction of bacteria by chemical action is due partly to the action of the antiseptic and partly to the changes it produces on the proteins or other substances making up these bacteria. Microbes in an aqueous solution are easily destroyed by antiseptics as the mixture contains no other proteins. Microbes which are found in blood serum, pus, or other exudates are harder to destroy as the antiseptic acts not only on the microbes but also on the proteid matter contained in such media. Therefore the germicidal action of an antiseptic must be tested under the last described conditions and not simply in an aqueous solution. The germicidal activity of all the known antiseptics is much diminished by the presence of blood, serum, or similar substances. In such conditions this diminution is so great that the substance employed becomes inert. After comparing the numerous agents with regard to bactericidal action and possible irritation of normal tissues, Dakin favors neutral hypochlorite of soda and also the chloralmines.

A. Dakin's Hypochlorite of Soda.

The antiseptic properties of sodium hypochlorite have long been known. It cannot, however, be utilized in wound sterilization in the form of Javel water or Labarraque solution as these are irritating and may seriously damage the tissues. Dakin, therefore, sought to diminish this irritating action of sodium hypochlorite without modifying its antiseptic action. (The

reader is referred for details to Dakin's article in the *British Medical Journal*, 1915. It may be stated that the modification consists in the neutralization of the free alkali which when present has caustic properties.)

I. BACTERICIDAL ACTION OF DAKIN'S SOLUTION

The results of experiments *in vitro* are of little significance as the conditions differ so greatly from the practical use. In wounds a small amount of pus is in contact with a large amount of the antiseptic as the hypochlorite solution is frequently renewed. In the laboratory tests the action of the hypochlorite on the microbes suspended in the pus is of short duration. If at the end of two or three hours one tests the amount of hypochlorite obtained in the mixture one finds sometimes a complete disappearance of the hypochlorite as it rapidly combines with the proteins of the pus and cannot be recovered as such. Because of this rapid disappearance of the Dakin solution when mixed with wound secretion it must be instilled into wounds either continuously or, if intermittently, frequently. This ignorance of the chemical characteristics of the hypochlorites has led some surgeons to manifest astonishment because a mixture of pus and hypochlorites after some hours' incubation makes a medium in which bacteria grow readily. It is self-evident that these mixtures after such treatment no longer contain hypochlorite.

The bactericidal action of the Dakin solution has been studied in infected wounds. If it is applied to a wound so that its concentration is constant and its application is prolonged the microbes disappear. This fact has been amply demonstrated. It is wise, however, to determine if the treatment is the principal cause of the sterilization and if this sterilization is due to the sodium hypochlorite.

(*a*) It might be inferred that in these cases wounds become spontaneously sterile. In reality, this occurrence is improbable as one never sees a series of infected wounds become sterile in a few days, but this hypothesis was worked out experimentally.

In one corner of a wound, all parts of which were uniformly infected, there was placed a piece of filter paper kept constantly wet with hypochlorite. A piece of similar size was put over another portion of the wound and the whole wound covered by a protective dressing. After twenty-four hours the granulations under the hypochlorite paper were smooth and red and the bacteria had entirely disappeared. Under the other paper the granulations were irregular and pale and the bacteria were undiminished. In the rest of the wound not covered by these two filter papers the quantity of bacteria was unchanged.

In a wound half of it dressed with hypochlorite the other with vaseline, total disappearance of the bacteria was obtained on the hypochlorite half with persistence of the infection in the other.

Similar results were obtained in deep wounds. Two shell fragments were odged in two contiguous wounds in the lumbar region. Both fragments were removed at one sitting. One wound was treated by intermittent instillation of the hypochlorite, the other by an ordinary dressing. The first wound remained painless and the bacteria disappeared completely from the smears obtained from the wound. The other became painful, was surrounded by a red areola and developed a streptococcus infection. In perforating wounds it was frequently noted that the region where the hypochlorite was instilled was sterile while at the other end where the hypochlorite did not penetrate there were numerous bacteria. Numerous similar observations demonstrated convincingly the relation of cause and effect between the treatment employed and the results obtained.

(*b*) It may be asked next if the result is due to the antiseptic action of the hypochlorite or to the mechanical action of the instillation of the liquid. The following experiments were made as bearing on this point. A patient had on his thigh two wounds of approximately the same dimensions and of a similar bacterial content. One wound (No. 1) was treated with the hypochlorite solution, the other (No. 2) with physiological salt solution. At the end of twenty-four hours No. 1 showed not a single microbe to a field while in No. 2 there were more than thirty to a field.

Similar experiments were made on superficial wounds on which were placed squares of filter paper of the same size. At the end of twenty-four hours the area covered by the filter paper wet with hypochlorite contained no microbes, that treated with saline contained many. (Experiments of treating infected wounds alternately with hypochlorite and saline gave convincing proof of the beneficial action of the hypochlorite.)

2. Action of the Hypochlorite on the Microbic Toxins. Several cubic centimeters of pus were obtained from a grave case of tetanus and divided into halves. To the first was added 2 parts of hypochlorite solution 1–100, to the second an equal amount of 0.8 salt solution. At the end of an hour 1 c.c. of each of these mixtures was injected into guinea-pigs. The guinea-pigs injected with the salt solution died of tetanus in eight to ten days, the others who had been injected with the pus treated by hypochlorite presented no signs of tetanus and survived.

Similar experiments with filtrations were made with the same results.

3. Toxic Action of the Dakin Solution. Sodium hypochlorite has very little toxic properties when introduced on the surface of wounds or into the subcutaneous cellular tissue of animals. It is dangerous if introduced into the circulation. It is strongly hemolytic. It should not be injected into a vein or injected under pressure in deep wounds lest it be absorbed by the tissues.

4. Action of the Hypochlorites on the Tissues. If the Dakin solution is applied to a wound surface for several days and occasionally for several weeks it will not usually cause any marked irritation. The action of the hypochlorite on the tissues is, however, much more marked *in vitro* than *in vivo*. In the wound non-vascularized tissues become dissolved and the surface rapidly becomes clean. If the integrity of a bloodvessel wall is affected the slough comes away quicker than in the usual wound healing. In the same way clots plugging vascular wounds may become dissolved by the action of the hypochlorite. It is therefore important to investigate carefully the conditions of vessels in the wound and make a particularly careful hemostasis.

5. Mode of Action of Hypochlorites. Dakin attributes the germicidal action to a chemical reaction similar to what occurs with ammonia and hypochlorite.

In the sterilization of a wound, the antiseptic performs the same function as does the scalpel in an operation. It is, therefore, only an instrument and does not constitute a method. The choice of a good instrument is essential to success. The chloralmines and the hypochlorites of Dakin are admirable instruments.

As Dakin's hypochlorite possesses the advantage of being strongly bactericidal, irritates the tissues very little and at the same time is easily and cheaply obtainable, it would seem to be the antiseptic of choice during this war.

II. THE CONTACT OF THE ANTISEPTIC AND THE MICROÖRGANISMS

The antiseptic solution sterilizing only what it touches must come in intimate contact with the organisms infecting the wound.

In order to know whether or not the antiseptic treatment could be applied to infected wounds it became necessary to study the infection both of recent and infected wounds and determine the possibility of bringing the antiseptic into contact with the microbes.

A. Topography of the Infection

1. The topography of the infection was first studied in fresh wounds, superficial or deep, with or without fractures. The smears were taken in different places, around projectiles, fragments of clothing, splinters of bone, and on their surfaces and examined microscopically and cultured.

In the first few hours the smears were generally negative but the cultures were positive. The apparent sterility of the smears was due to two causes: dilution by the blood of the microbes and their relative infrequency in the early period of the infection, for they need time to multiply.

At the end of twelve hours the bacteriological examination showed bacteria more constantly and in greater numbers. The wounds showed some reaction and the polynuclear cells became more or less numerous.

In twenty-four hours the topography of the infection had changed considerably, the bacteria were no longer localized on the surface and around the foreign bodies, the smears showing their presence throughout the greater part of the wound. At the same time an increase of the polynuclears was noted. That is, in the first twenty-four hours there was a multiplication of the microbes on the surface and in the vicinity of the foreign bodies, especially pieces of clothing, and later their diffusion in the limits of the wound. The difference bacteriologically in a wound from the fifth or sixth hour to the twenty-fourth hour was due to the rapid multiplying of the microörganisms.

The study of the numerous wounds showed that the organisms generally remained on the surface rather than penetrating deeply into the intermuscular spaces or the lymphatics. They invaded blood-clots and devitalized tissues, and they followed extravasated blood in the vascular tracts and thus could reach the fractured bones. Habitually, however, in the first few hours, sometimes the first few days, they remained on the surface, that is, within reach of a solution, if such a solution was introduced under favorable conditions. This fact was well demonstrated in the wounds. When the antiseptic solution was brought into contact with the infected surface the number of bacteria rapidly diminished and the wound shortly became aseptic.

Suppurative wounds, therefore, were sterilized within twenty-four hours; the deeper, even accompanying the compound fractures, in five or six days. It was possible indeed when the treatment had been applied at the start to close such wounds by deep sutures and get results comparable to those of primary union.

2. Suppurating Wounds. During the period of suppuration it was generally more difficult to bring the antiseptic in contact with the microbes, but depending on the form and nature of the wounds microbes were more or less easily influenced by the

liquid. The chief difficulty was in dealing with necrotic tissue and sloughing tendons and aponeuroses which prevented the action of the antiseptic on the microbes with persistency of infection. Re-infection is, of course, more probable in such wounds, rendering it more difficult to obtain the primary union after suture. It is therefore most important to sterilize the wound at the earliest period of infection.

B. Preparation of the Wound for the Introduction of the Antiseptic .

This preparation consists above all in the mechanical cleansing of the infected regions. Free incisions of the soft parts permit of such a cleansing even in compound fracture. It is known that the pieces of clothing, projectiles, detached bony fragments, blood-clots, and necrotic tissues harbor the bacteria and protect them against the antiseptic. Therefore, all such foreign bodies must be carefully sought for and removed. Fragments of clothes are the principal source of infection. Necrotic tissues are the favorite habitat of the gas bacillus. Systematic resection of all the tissues, skin, aponeurosis, and muscles which are devitalized as practised by Depage is an excellent procedure and should be generally employed. The surfaces of bony cavities in which projectiles have been imbedded should be scraped or resected. It should be noted that tampons placed in wounds efficiently protect microbes against the action of the antiseptic.

Incisions should be planned to expose all recesses of the wound as much as possible. The liquid must penetrate everywhere and remain in contact with the infected surface so long as necessary, that is, the weight of the liquid plays an important part. Wounds which can be filled as a vase are most suitable for sterilization (Fig. 3). Therefore, incisions should be preferably located on the anterior surface of the limb without a posterior counter opening, thus retaining the liquid in the cavity and completely bathing its walls.

Technic of the Manufacture of Dakin's Solution

One of the essential conditions for the sterilization of wounds require, as is well known, a substance which can be used a long time on the wounds in a fixed concentration without producing irritation. The proportion of alkali in Javel water and in Labarraque's solution is capable of dissolving the skin if contact is sufficiently prolonged. Dakin, therefore, sought to obtain a solution free of caustic alkali and the hypochlorite contained should strictly fall between 0.45 and 0.5; below 0.45 the solution is not sufficiently active, above 0.5 it is too irritating. The earlier solution of Dakin has been modified by Daufresne. It is as follows:

To make 10 liters of the solution:

1. Weigh exactly chloride of lime (containing 25 per cent. of active chlorine), 184 grams; dry carbonate of soda, Solvay, 92 grams (or crystalline carbonate of soda, 262 grams); bicarbonate of soda, 76 grams.

2. Into a 12-liter jar put the chloride of lime and 5 liters of ordinary water. Stir vigorously two or three times and let it settle over-night.

3. Dissolve the carbonate and bicarbonate of soda in 5 liters of cold water.

4. Pour the whole solution of salts of soda in the vessel containing the macerating chloride of lime. Stir vigorously for a minute, then let it settle to allow precipitation of the carbonate of soda.

5. In half an hour siphon off the clear liquid and filter it with double filter paper to obtain a perfectly clear fluid, which must be kept in a cool place and in the dark.

The antiseptic solution is then ready for surgical use. It should contain 0.475 of the chloride of lime with small quantities of neutral soda salt. It is definitely isotonic to blood serum.

The proportion of 184 grams of chloride of lime to 10 liters of water corresponds to a product of good average quality (25 per cent. of active chlorine), but variations from the above are frequently encountered.

Daufresne has constructed a chart which gives the proper proportion of ingredients according to the amount of active chlorine contained in the chlorinated lime as determined by titration.

Titer of chlorinated lime.	Chlorinated lime, grams.	Anhydrous sodium carbonate, grams.	Sodium carbonate, grams.
20	230	115	96
21	220	110	92
22	210	105	88
23	200	100	84
24	192	96	80
25	184	92	76
26	177	89	72
27	170	85	70
28	164	82	68
29	159	80	66
30	154	77	64
31	148	74	62
32	144	72	60
33	140	70	59
34	135	68	57
35	132	66	55
36	128	64	53
37	124	62	52

Preservation of the Solution. Solutions of hypochlorite do not maintain their stability indefinitely, especially if exposed to light. Therefore they should be kept in a dark place and should be made fresh as often as possible, at least every ten to fifteen days. (In large clinics this solution is made, and probably wisely, daily.)

Sources of Error. By following the rules laid down by Dakin and Daufresne the solution of hypochlorite of soda always fulfils the requirements. Experience has shown that in some hospitals where Dakin's solution was said to have been employed there was used frequently under this name variable mixtures, more or less dangerous. These defective solutions which irritate the tissues and fail to sterilize wounds were the result of more or less gross technical faults.

It is important to note that the details of the technic as described must be strictly followed if one wishes to obtain a Dakin solution of characteristic properties, for the technic of the sterilization has been calculated on the use of a liquid containing a concentration of the properties of the Dakin solution, so that any modification of this solution robs the method of its precision and efficiency.

Technic of the Sterilization of Wounds

I. MECHANICAL CLEANSING

The first part of the treatment consist in preparing for the penetration of the solution into the wound by surgical intervention and mechanical cleansing of the wound. This intervention is indispensable in order to effect intimate contact of the antiseptic and the bacteria.

1. The Time of the Mechanical Cleansing. The surgical intervention and the mechanical cleansing are carried out as soon as possible after injury. Every infected wound passes first through a period which may be termed pre-inflammatory—the various local symptoms being slight or absent. It is essentially the period during which, as far as possible, necessary intervention must be performed.

2. In from twelve to forty-eight hours, sometimes later, the inflammatory period begins, with elevation of temperature and obvious local manifestations of infection. This period may last for days or weeks. While the patient remains in this condition surgical intervention such as one would have done in the first twenty-four hours is not indicated. Free incisions and a prolonged search for foreign bodies or detached pieces of bone may provoke a septicemia or at least an aggravation of the pain and the local phenomena.

3. When the period of acute infection is over and suppuration has begun such search and procedures may be done with much less danger. Osteomyelitis has, however, some time begun

and the cleansing of the wound is no longer so efficacious as at first. In other words the most valuable time for operation is the pre-inflammatory period.

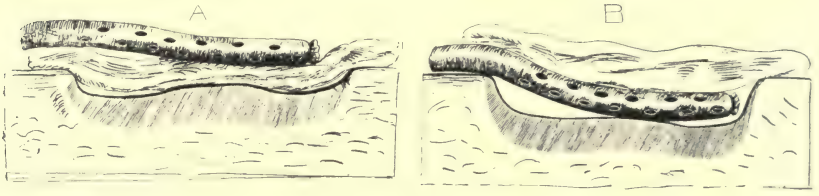

FIG. 1.—*A*, defective application of tube; *B*, correct application of tube.

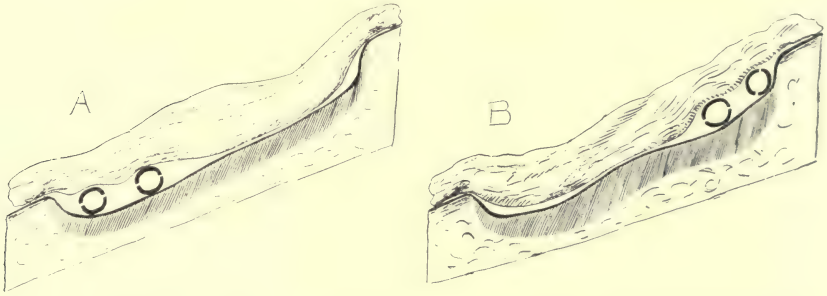

FIG. 2.—Oblique wound. *A*, tubes wrongly applied at bottom of wound; *B*, tubes correctly applied at top of wound.

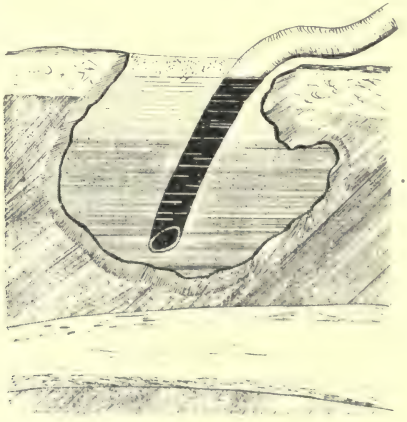

FIG. 3.—Wound with opening on upper surface filling up as vase.

II. THE TECHNIC OF MECHANICAL CLEANSING OF THE WOUND

1. Both a general examination and a careful local examination must be made before intervention in order to determine the possibility of such intervention as well as its extent and the time required. Armed with such information one proceeds as soon as possible to the mechanical cleansing of the wound.

2. ANESTHESIA. A general anesthetic must always be employed. In certain cases spinal anesthesia may be used.

3. INCISION AND CLEANSING OF THE WOUNDS AND THE SOFT PARTS. The skin is sterilized with tincture of iodin. Wounds of entrance and exit too small to permit any examination of the course of the foreign body must be enlarged. It is necessary to inspect the entire field visually, especially when a fracture exists.

No hesitation need be felt in making large incisions, as in a few days they can be closed. A large incision of the soft parts generally permits of early closing.

(*a*) An excision of the contused portions of the tract is carefully performed. Depage and his followers deserve credit for showing the great usefulness of pretty complete resection of the whole tract of the missile.

(*b*) *Hemostasis.* This must be performed very carefully, and it is important to verify the extent of extravasation of blood into the cellular spaces, especially when there has been a wound of a large vessel. Infection spreads with great ease under such conditions and may be of a particularly serious nature.

(*c*) *Extraction of Projectiles and Fragments of Clothing.* If a wound is cleansed within a few hours after injury and the foreign body is small it is generally easy to find as the eye can follow the route of the projectile easily. It may be necessary to have recourse to some of the numerous and useful forms of apparatus for the location of foreign bodies. It is even more important to remove the fragments of clothing.

(*d*) *Drainage.* Free drainage must be established, but differently from the customary methods. Counter openings on the

dependent surface should not be made lest the antiseptic solution escape from it.

4. Cleansing of Wounds Complicated with Fracture or Articular Lesions. (*a*) *Cleansing of the Site of Fracture.* Incisions which serve for exploration and cleansing of fractures must always be very large. In fractures of the femur it is particularly important to make a large incision and separate the muscular bundles in order to follow the bony fissures to their full extent. Loose spicules of bone are often found between the fractured surfaces and in the medullary canal. These should be removed. The medullary canal is explored in longitudinal fractures and the marrow should be removed. All fragments adherent to the periosteum are preserved as experience has shown that fragments so treated are sterilized without sinuses and become readily united. On the other hand the very free removal of these fragments so often performed in the Field Ambulances have given deplorable functional results. Bony lesions, often the severest, should not be submitted to immediate amputation except in extensive crushing of the bone or in the destruction of the vascular nervous bundles. In this way it is possible to preserve limbs, which otherwise would be destined to amputation.

(*b*) *Cleansing of Articular Lesions.* When the synovial membrane alone is affected the projectile is removed and the articulation emptied of blood. The infected region is isolated from the rest of the region by compress or suture and the instillating tube is placed at the site of the foreign body. If the bony lesions are very extensive resection may be necessary. Primary articular resection must be made circumspectly for a chemiotheraphy often results in healing of extensive lesions, which under any other treatment would require resection.

B. Inflammatory Period

The inflammatory period generally begins twenty-four to thirty-six hours—sometimes later. Two forms of infection are

observed, the gangrenous and the phlegmon. The first is of a more rapid evolution.

Our line of conduct will vary according to whether the infection is gangrenous or phlegmonous.

1. Gangrenous Infection. This occurs in three forms—septic, grave local form, and the gaseous phlegmon.

(*a*) The septicemic form requires immediate amputation, giving the patient what little chance there is for preservation of life.

(*b*) *Local Gas Gangrene.* There are two forms, the superficial and the deep. The superficial yields readily to free incisions and chemical disinfection. The deeper form affects principally the muscles. While this form may yield to free incisions and chemical disinfection it may be necessary to perform an amputation, which is done fairly close to the limits of the infection and the stump left wide open.

(*c*) *Localized Gas Gangrene.* This is a more benign form and often becomes localized to a certain muscle. This form is particularly adapted to treatment with the Dakin solution.

2. Phlegmonous Infection. The treatment may be summarized in saying that it is different from that adapted to the pre-inflammatory period. When the infection is well developed in a wound it must be limited at first by the simplest methods and leave for further procedures the surgical treatment necessitated by anatomical lesions and by projectiles.

Secondary Hemorrhage. Such hemorrhages have occurred in certain hospitals as a result of employing an imperfect Dakin solution. The solution contains probably free alkali capable of provoking vascular ulcerations as will Labarraque solution and Javel water. In wounds sterilized chemically we never see secondary hemorrhages due to suppuration.

C. Period of Suppuration

Manipulation of wounds in this period is done more cautiously, as in a way it coincides with the inflammatory period. There are two types: One is covered with more or less sanguine-

ous pus and accompanied with lymphangitis, swelling and pain. This is the period of transition between the inflammatory period and the suppurative period properly speaking. Unless there are urgent indications these suppurating wounds must be treated in the same manner as wounds of the inflammatory period. The other type represents the older lesions. Thick pus escapes from the orifice covered by granulations and the tissues show no edema. Temperature is little elevated and shows marked variation. In this period surgical intervention is as possible as in wounds of the first type.

1. Chemical Cleansing. In a great majority of these cases the wounded referred to the hospital at the end of from two to fifteen days have already been operated on. It is preferable not to interfere at once but content one's self with minor procedures and the instillation of the Dakin solution as best one can.

2. Surgical Cleansing. At the end of a little while in all compound fractures the improvement produced by the instillation of the antiseptic comes to a standstill. The wound then may be cleansed as if it were a fresh wound.

3. Chemical Sterilization. The surgical cleansing is followed by application of the instillation tubes just as if it were a fresh wound.

D. Cicatricial Period

Cicatrization is not indicated at the end of infection. It is therefore prudent in these secondary interventions not to suture the wounds and place in the depths one or two tubes for the introduction of the antiseptic liquid. In this way rapid sterilization of operative wounds is obtained and accidents due to reinfection are avoided. Later when the wound is determined to be really aseptic it may be closed.

Resumé of the Practical Application of the Carrel Method

The method is applicable chiefly to the disinfection of fresh wounds, say within twenty-four hours from the time of inflic-

tion, more particularly compound fractures. Most of these cases will require cleansing under an anesthetic, the thorough removal of all foreign bodies, fragments of shells, etc., with the trimming away of loose portions of tissue and the establishment of very free drainage. Instead of using gauze, ordinary rubber tubing, etc., for drainage, the wounds are filled with a large number of small rubber tubes to carry in the Dakin solution. Each tube is about the size of No. 16 French, perforated at the end with a number of small holes, and usually tied off at the open end to allow the fluid to run out of the smaller holes. The fluid is introduced at a pressure of 1 meter, and on account of the numerous holes of small size the fluid is forced out very much like a spray. Each tube is destined to spray a limited section of the wound so a very large wound may require a dozen or more tubes. These tubes are coupled up by special branch tubes of glass devised by Carrel which lead to the tank containing the Dakin solution over the patient's bed. The dressings are applied largely in one piece and are made very light, the theory being not to have a big dressing into which the fluid simply accumulates.

The Dakin fluid is admitted by releasing the stopcock of the irrigator and allowing a prescribed quantity of the fluid to flow out into the small tubes every two hours. The amount will vary according to the number of tubes and the size of the wound. The object is to keep the wound damp without flooding it, and the exact amount of fluid has to be studied by the typical condition of each wound and by experience. If the fluid soaks through the dressing it shows too much is being used. The fluid is somewhat irritating and it is wise to protect the skin which may come in contact with it by cloths soaked in yellow vaseline. This procedure is better than applying the vaseline directly to the skin, and the yellow vaseline is more efficacious than the white.

The wounds are dressed daily, particularly to control the condition of the tubes and test their working efficiency. The tubes are changed or renewed according to the condition of the

wound; if they do not become clogged or foul they may serve for several days.

Under this treatment fresh wounds do not develop infection, and there is practically no suppuration whatsoever. The average wound will become sterile inside of ten days. The sterilization of the wound is easily appreciable clinically from the total absence of reaction, suppuration, pain, redness, edema and the absence of constitutional manifestations, which are very marked.

The actual sterilization is demonstrated by the daily (or every other day) examination of the wound secretions for bacteria. From different parts of the wound a loop of secretion is taken which is spread on a slide and stained by a suitable stain. At the beginning the number of bacteria is infinity, but it is noted that the average number of bacteria in a given field diminishes, and usually quite steadily, until finally one may have to hunt through several fields before finding any.

Both Depage and Carrel have constructed charts to describe this percentage of bacteria graphically. When the chart reads under the zero level for some time, say six days, and as the conditions lend themselves to it, the wound is "closed." Under this sterilization these wounds, after refreshing the skin edges, mobilizing flaps, etc., are sutured and heal very much as a fresh wound. Little is done in the way of refreshing wound surfaces excepting skin edges. A plug of obstructing granulations, if necessary, is shaved off.

These wounds heal in a manner that is simply indescribable. One has to see the behavior of these sutured wounds one's self to realize what happens. They heal with no more reaction from their appearance and manifestations than would be given by a wound which has been sutured on a cadaver—total absence of reaction, pain, swelling, redness, and even of infiltration around the wound edges. Dr. Dehelly, of Havre, tells me that he has closed 400 of these wounds with only 6 failures to obtain perfect primary union. Of these six mishaps none was of any importance and in some of these Dehelly said the fault was probably due to his failure to await complete sterilization as evidenced by the bacterial count.

Carrel realizes that the method requires a good deal of personal attention and is seeking to modify it by having an antiseptic which may be readily and continuously diffused all over the wound surface. He would like to use it very much as one does Beck's paste, which permeates every nook and cranny of a given cavity. For superficial surfaces he is using a chloralmine ointment. So far he has not been able to find a suitable medium to introduce into deep wounds.

During his recent visit last winter to New York he told me that he was obtaining a full measure of success in the sterilization of old wounds but the process of combating long standing suppuration was very different from the prophylaxis of infection in recent wounds.

The Carrel method requires a proper appreciation of the principles of the treatment and an intimate knowledge of the technical details. As has been noted the method consists of a series of steps, each one forming links in a chain, and the giving away of any one of these links destroys the usefulness of the whole structure. Much misconception exists about the method, and it is supposed to be the application of a fluid containing hypochlorite of soda into wounds in some sort of fashion. These imperfect methods have been used, poor results have been obtained, and in some cases disastrous. Consequently the method has been condemned. It was most interesting to me to note last summer the divergence of views on the usefulness of the method. When I arrived at Paris before going to Compiegne I found that the majority of the "high priests" of the surgical profession not only did not believe in the method but opposed it most acrimoniously. Investigation showed that the hostile party represented the party of ignorance; that is, I found that no one of the opponents with whom I discussed the matter had even taken the trouble to go to Compiegne, sixty miles away, to study the method at its source; also, that some who had gone there had not realized the finer points of the technic or the necessity of scrupulously observing them.

I visited the clinic of a very excellent surgeon, who enjoyed

in Paris the reputation of having mastered the technic, and found (1) that he was not getting very good results, and (2) that he was grossly violating some of the fundamental principles of the method. Commenting on this to Carrel on my second visit to Compiegne he smiled and said, "The gentleman stayed here only an hour." Another surgeon who had employed the method but not thoroughly, and with consequent results, advised me not to stay any great time at Compiegne as "it will only take you a couple of hours to get the whole thing."

On the other hand, every surgeon, particularly the Americans, who took the trouble to study the method with Carrel or Depage or Dr. Lyle became without exception profoundly convinced of the value of the method and its superiority to all procedures hitherto employed.

The particular pitfalls which I have observed are:

1. The improper preparation of wounds and failure to remove foreign bodies, necrotic material, etc.

2. By failing to make free incisions and suitably placed incisions in which every portion of the Dakin fluid can come into direct contact with all portions of the wound.

3. Failure to utilize tubes of proper caliber with suitable perforations as regards size, number and situation; failure to place them so that every portion of the wound is properly moistened by the solution.

4. Failure to introduce the fluid under proper pressure so that all the fluid shall run out as a spray and not to trickle out of the first hole.

5. Introducing the fluid under too much pressure. Excess of pressure is produced (Carrel and Dehelly) either by too great an elevation of the container or with small-sized incisions which prevent the easy outflow of the fluid between the wall of the wound and the tube (Fig. 4, *A* and *B*). This excess pressure is manifested by pain. If the introduction of the fluid at any time causes the patient pain it must be discontinued and the technical fault corrected.

In addition to pain too great a pressure may result in absorp-

tion of the fluid with resulting hemolysis and possibly death in a short time. It is quite possible that in certain wounds, as for instance an appendiceal abscess in which a loop of gut presents, absorption may take place with disagreeable and perhaps fatal results if the condition is not recognized. On one occasion there was quickly produced a change in the patient's condition and transitory jaundice. So soon as these manifestations appeared treatment was discontinued and the patient recovered.

6. Failure to place the tubes so that the fluid runs down hill and not up hill, a very frequent source of error as I have found (Fig. 2, *A* and *B*).

FIG. 4.—*A*, orifice too small—fluid is under pressure and cannot escape; *B*, proper sized orifice, permitting the free escape of fluid between wall of wound and tube.

7. Failure to locate the perforations in the tubes so that they are all contained within the wound, not allowing the fluid to run out on the skin.

8. The use of too much fluid so that the wounds are drowned out and the fluid runs out on the skin with disastrous results.

9. The use of packing and tampons in the wound which prevents free access of the fluid to the bacteria (Fig. 1, *A* and *B*).[1]

10. Failure to realize the evanescent character of the hypochlorite and its dilution by wound secretions, in that the wounds are not moistened regularly every two hours as prescribed.

11. Failure to protect thoroughly the skin with a yellow vaseline smeared on gauze.

[1] Illustrations from Carrel and Dehelly.

12. Failure to use the correct solution which is usually lacking in strength, there being only 0.5 per cent. margin between efficiency and danger. In addition to the difficulty of getting

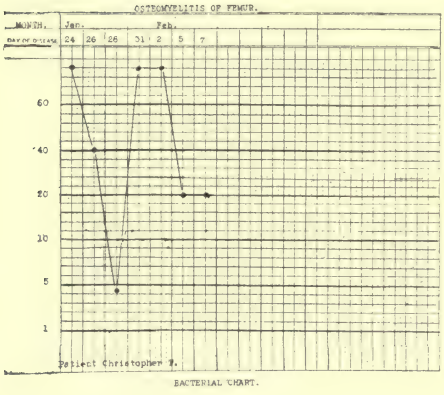

FIG. 5

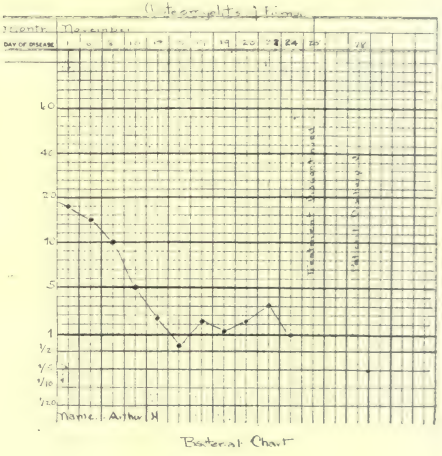

FIG. 6

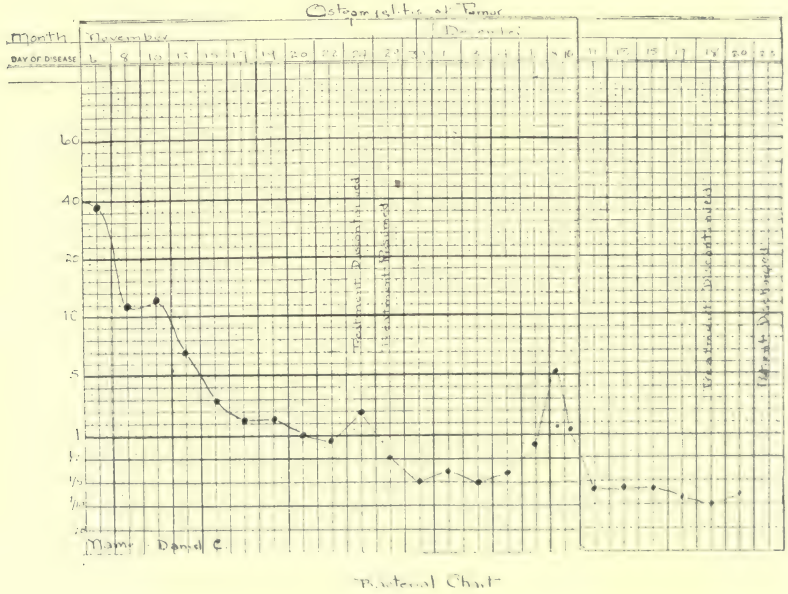

FIG. 7

perfectly correct proportions of the active chlorine there is a very grave danger of over-alkalinity, giving rise to burning and caustic action in the wound. The proper solution should never

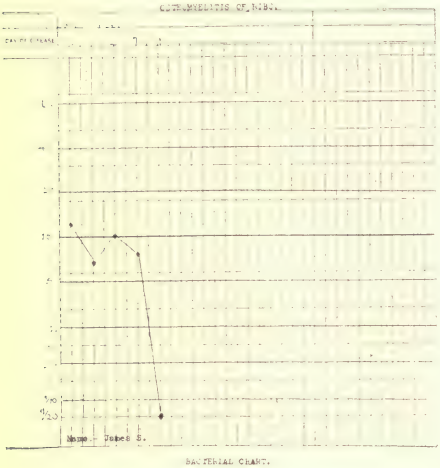

FIG. 8

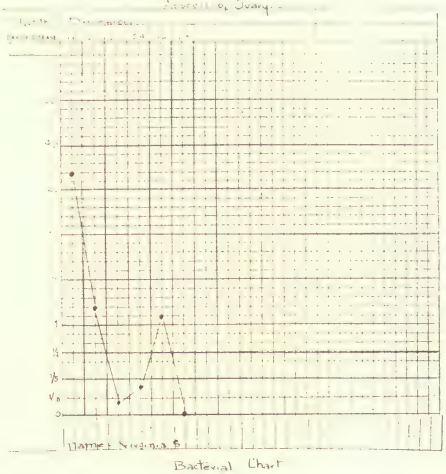

FIG. 9

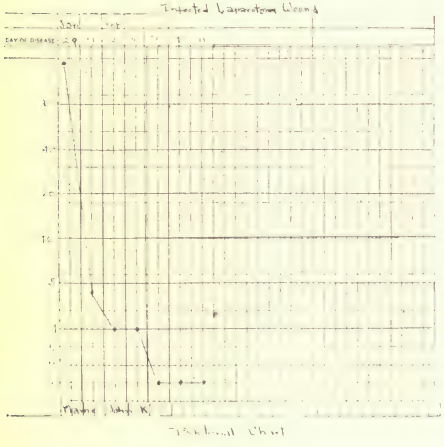

FIG. 10

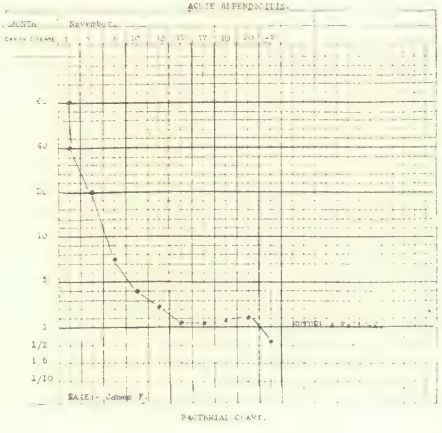

FIG. 11

cause any pain. The appearance of pain should be a signal for the immediate discontinuance of the solution and an investigation of its accuracy.

As regards the results of the Carrel method in my service since its introduction October, 1916, I have not been able to give it a very thorough trial, as I have lacked the more ideal

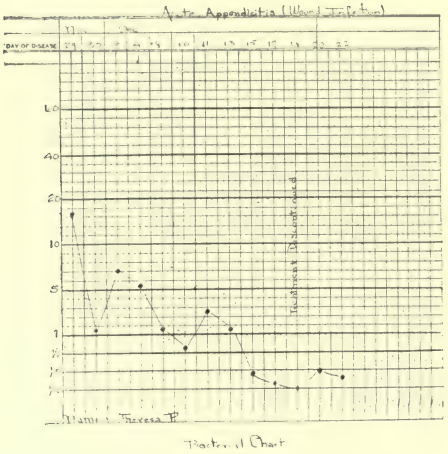

FIG. 12

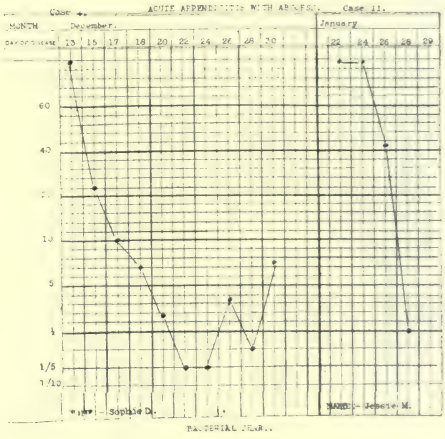

FIG. 13

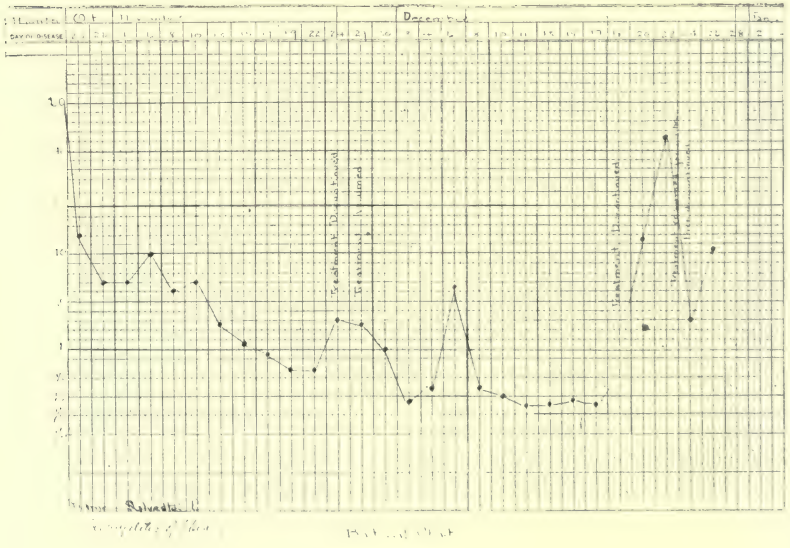

FIG. 14

cases, namely, the extreme degrees of trauma, especially compound fractures. I have had to limit it mostly to old suppurations. I can say in general, that while the method so applied has not worked any miracles I feel, and I think am supported by my colleagues, that we have been able to control suppuration more promptly than by any other method and certainly the results of the bacterial examinations as recorded in our charts show in practically all instances an immediate and constant diminution of the bacteria.

Figs. 5 to 14 show a series of consecutive cases depicting the very consistent drop in the bacterial count after institution of the Carrel method:

A REPORT OF THE USE OF DICHLORAMIN-T (TOLUENE-PARASULPHONDICHLORAMIN) IN THE TREATMENT OF INFECTED WOUNDS

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THE search for the perfect germicide began when Lister first applied the principles of Pasteur to the practice of surgery. The perfect germicide should meet two simple requirements: It must kill all parasitic life, while causing no harm to any cell of the living body.

The problem has been partially solved for certain groups of infective agents, all of which, however, belong to the lower forms of animal life. The infective agents more closely related to the plant kingdom, the bacteria, have shown a greater resistance to lethal agents than is possessed by the cells of the animal body, and therefore the great problem of surgery, the prevention and control of bacterial infection, remains only partially solved.

The lethal effect of all the usual germicides on the animal cells, with the clinical result of retardation and inhibition of the natural processes of repair, have become so well recognized of late years that an attitude of antiseptic nihilism has existed. Surgeons have developed a technic which has depended somewhat

on soap, water and alcohol, but chiefly on the natural bacterial resistance of the patient.

In civil surgery, in which by far the large majority of the wounds were primarily clean, this technic was usually sufficient to prevent the introduction of infective agents in numbers, or virulence, beyond the natural resistance of the patient. In that small proportion of cases in which the primary wound was overwhelmingly infected, as acute suppurations and infected traumatic wounds, clinical experience had shown that the small germicidal effect of practically all of the classical agents was nearly always overbalanced by their destructive action on the human tissues. Thus the routine treatment consisted in mechanically removing the cause whenever possible, instituting drainage, when indicated, with the subsequent constant or interrupted use of physiological sodium chlorid solutions, in this way trying to avoid the destruction of the human tissue cells without interfering with the processes of natural immunity and bacterial resistance.

The demands made on surgery by the extensive suppurating wounds of modern warfare have reopened this question and made necessary a further search for an agent which would meet the requirements of a perfect germicide. In military surgery the problem has not been one of the prevention of infection, asepsis, but up to the present distinctly one of treatment of infection, antisepsis, for practically all military wounds, with the exception of a small proportion of bullet wounds, are virulently infected before coming into the hands of the surgeon.

The personal experiences of two of the writers, working with both the English and French wounded, were the same as those reported by the majority of military surgeons, namely, with the exception of the chlorin preparations, all other antiseptic agents, in sufficient strength to be germicidal, hindered rather than helped in the control of suppuration and the process of repair.

The results reported from the use of Dakin's and later Daufresne's modifications of Labarraque's solution are now known to every student of surgical progress and accepted by all those

who have had the privilege of personally observing the work. Yet there are certain objections to these chlorin-containing solutions which constitute real obstacles to their general use: 1. The solutions currently used must be made with extreme care, and, being very unstable, it is almost necessary to have them freshly made daily. 2. All of these chlorin solutions irritate the skin if they remain in contact with it for any length of time.

The phenomenon of skin irritation is a definite obstacle to the use of these preparations, and in the experience of two of the writers there have been a number of cases in which the skin irritation, or burn, as it is called, has persisted for months after the wound has healed. The burning, itching and pain of these skin reactions are of such a degree that it has been necessary to find some means to prevent or at least minimize the phenomena. At Compiègne and LaPanne, Carrel, Dehelly and Depage have evolved a technic which will minimize this annoying irritation if carried out in its minutest detail; and from our personal experience, the success or failure of the method depends entirely on the degree of perfection with which the details of this technic are mastered and carried out.

The Carrel-Dehelly-Depage Technic. The Carrel-Dehelly-Depage technic consists essentially in: (1) The constant protection of all portions of the skin exposed to the chlorin solutions, or to the dressings containing the solutions, with vaseline. This is usually applied on strips of sterile gauze. (2) The use of very weak solutions of the hypochlorites. Below 0.4 per cent. of nascent chlorin the clinical effect of these solutions is very slight, while above 0.5 per cent. the irritating effect on the skin becomes serious. Therefore a concentration of 0.48 per cent. is usually employed. By weakening the solutions in order to avoid skin irritation other problems are developed, the most difficult of which is that of making effective such minute quantities of a relatively weak germicide as is contained in a 0.48 per cent. solution of hypochlorite. Keeping the entire wound surface constantly moistened and in contact with the solution would seem to offer the maximum germicidal effect that could be

expected, but the ease and rapidity with which these antiseptic substances unite with the protein and other substances in the wound exudate results in their rapid disappearance, in from thirty minutes to an hour, so that it is necessary not only to have the wound surfaces always in contact with the weak solutions, but also to provide for a frequent renewal of the solutions. It is largely because of these reasons that in the technic of those who have obtained really satisfactory surgical results with weak hypochlorite solutions one sees such minute care exercised in complete and constant immersion of all the wound surfaces with frequent and regular renewal of the solution.

In the Carrel-Dehelly-Depage technic a constant immersion of all the wound surfaces is maintained by a complicated hydraulic system. From a reservoir the solution is carried through a series of rubber tubes to every nook and cranny and fills the wound cavity just to the point of overflowing. By means of stopcocks the solution in the wound cavity is renewed at will, and without necessarily changing the whole dressing. The opening of a cock in the outlet tube from the reservoir flushes out the wound according to the principles of overflow, and leaves the cavity refilled with a fresh solution.

If all the conditions of the Carrel-Dehelley-Depage technic are carried out in the minutest detail, our experience has shown that infected wounds in military, industrial and civil practice can be sterilized in a remarkably short time, and when it is mechanically possible, such sterilized wounds can be closed, and they will heal as one would expect a sterile one to do. While not minimizing the wonderful surgical opportunities such possibilities open up, for it would seem to us that it means the fulfilment of Lister's first vision of antiseptics, we do feel that this technic requires an unusual degree of painstaking care (not peculiar skill) on the part of the surgeon and the nurse, and it is not only time-consuming, but also demands unusual expense for both apparatus and dressings. The concrete expression of this is seen in the large personnel and generous budgets at Compiègne and LaPanne. When one realizes that this complicated technic

has been devised primarily to avoid or minimize the skin irritation following the use of the hypochlorites, it certainly seems justifiable, and to us necessary, to search for another solution of the difficulty of skin irritation.

The Problem of Skin Irritation. From investigations made by one of us (Dakin) as to the mode of action of the various hypochlorite preparations used in the treatment of infected wounds, it appears that when hypochlorites react with proteins of any kind, one of the first reactions consists in the formation of substances containing the NCl-group. These products, which belong to the group of chloramins, possess marked bactericidal properties and are the active germicidal agents produced by the hypochlorites when they come in contact with the wound exudate.[1] These chloramins are non-irritating to animal cells, and this explains the absence of irritation in the wounds, where the irritating free chlorin of the hypochlorite has been changed into chloramins and other non-irritating protein derivatives.

It is quite simple to prepare these chloramins synthetically, and one of these substances in the form of a sodium salt of toluene-parasulphonchloramin has been used quite extensively as a germicide and is now being sold under the trade name of chlorazene. This synthetic chloramin is non-irritating to the skin and wound surfaces, and can be used in aqueous solutions in a concentration of 2 per cent., which has approximately four times the germicidal value of the currently employed solutions of hypochlorites.

The desirability, however, of using strong concentrations of these germicides is clearly shown by the work of C. J. Martin and Miss Chick, on the laws governing disinfection. They have definitely shown that a very complete analogy exists between ordinary chemical reactions and the process of disinfection, one reagent being represented by the disinfectant and the other by the protoplasm of the bacterium. If the act of disinfection is thus regarded as a chemical reaction proceeding with definite

[1] Proc. Roy. Soc., 1916, B. lxxxix, 232.

velocity, the successful use of germicides will depend on the establishment of conditions such as will permit the reaction to be pushed as far as possible toward completion in any given period of time. Maintenance of the active mass of germicide will obviously favor the course of disinfection. We have already referred to the difficulties encountered in maintaining an effective mass of germicide in the wound in the use of hypochlorites—and this is true to a lesser degree with the synthetic chloramins—because of the ease with which these substances unite with proteins and other compounds in the wound exudate and so lose their activity. By the use of an aqueous solution of synthetic chloramin of 2 per cent., we felt that a definite advance had been made in having a non-irritating germicide whose mass was four times that of the hypochlorites; but there was no improvement in the problem of maintenance, for in aqueous solutions these synthetic chloramins also disappeared rapidly in the wound exudate and had to be renewed at least every two hours.

One obvious method of overcoming this objection of rapid disappearance of the antiseptic was to dissolve an excess of the substance in some medium which would not only contain the desired large concentrations but would also hold it over a long period of time, as in oil, so that the germicide would slowly diffuse into the surrounding medium and thus permit the use of a large mass of germicide which at the same time would act (be maintained) for a longer period of time than would be possible with aqueous solutions.

At present we have made use of a dichloramin, first prepared by Kastle, Keiser and Bradley,[1] and later by Chattaway,[2] the synthetic name for which is toluene-parasulphondichloramin. We propose to give it the name dichloramin-T. As a solvent we have used eucalyptol chlorinated as described below with or without liquid paraffin, similarly chlorinated, to limit their decomposing action on the dichloramin-T.

[1] Am. Chem. Jour., 1896, xviii, 491.

[2] Jour. Chem. Soc., London, 1905, lxxxvii (1), 145.

The solutions are not permanent, especially in the presence of liquid petrolatum; but a 10 per cent. solution of dichloramin-T in eucalyptol may be kept in a glass-stoppered amber bottle for at least one month with but 25 per cent. decomposition.

It may here be noted that these substances were first used by Dunham and one of us (Dakin) in experiments on nasal antisepsis which will be reported shortly.

We offer as a solution of the serious obstacle of skin irritation of the usual chlorin preparations a practically stable, non-irritating, synthetic double chloramin compound, toluene-para-sulphondichloramin or dichloramin-T, this solution to be used in strengths varying from 5 to 10 per cent. (from twenty to forty times the mass of germicide ever present in the usable concentrations of hypochlorites) dissolved in a chlorinated oil in order that the germicide will be slowly liberated over a period of from eighteen to twenty-four hours instead of from thirty minutes to one hour, as with the hypochlorite solutions.

The Use of Dichloramin-T. The technic of its application is simplicity itself, in contradistinction to that of Carrel, Dehelly and Depage. After a careful surgical preparation of the wound at the primary dressing, and excision of all foci of infection and of devitalized tissues, the solution is applied on surface wounds with an atomizer in the form of spray. In deep wounds the cavities are filled with the liquid. When dependent drainage exists because of the location of the wounds or when it has been purposely made, the lower opening is temporarily closed with gauze and then the cavity is filled with the oil, thus covering all the wound surfaces. The dependent drainage is then reëstablished by removing the temporary gauze obstruction.

This privilege of dependent drainage cannot be practised with the use of aqueous solutions and the Carrel-Dehelly-Depage technic, in which the wound must act permanently as a basin to hold the weak solution. We feel that too much stress cannot be laid on this advantage.

We have found that it is necessary to apply the oil but once in twenty-four hours, and the wounds should be covered only with a

few layers of gauze to avoid the absorption of the oil by the dressings.

The clinical phases of these problems have been developed at a special clinic organized at the Pennsylvania Hospital for the care of industrial accidents.

At first the Carrel-Dehelly-Depage technic and the Dakin-Daufresne modified Labarraque's solution was used. The results in 160 completed cases treated during the first two months showed that the patients in this group, including wounds of the soft tissues, tendons, bones and joints, were discharged recovered in one-third the time required by the average of the other hospitals of the city. The comparison was made by means of insurance statistics. For the last two months, the complicated and expensive Carrel-Dehelly-Depage technic has been replaced by the routine use of daily dressings of first 5 per cent. and later 7.5 per cent. of dichloramin-T in chlorinated eucalyptol and liquid petrolatum. In this last group of 82 completed cases the time required for healing was 16.3 per cent. less than in the former.

If we had only obtained as good results from this method as from the hypochlorites, the simplicity of the technic and the saving in dressing material, less than one-third of the former amount being used, would have insured its replacing the former method.

Preparation of Dichloramin–T. The following details were worked out for Chattaway's method of preparation:

Chlorinated lime (from 350 to 400 gm.) of good quality (of 25 per cent. or more of available chlorin) is shaken with 2 liters of water on a shaker for half an hour, and then the mixture allowed to settle. The supernatant fluid is siphoned off and the remainder filtered.

Powdered toluene-parasulphonamid, 75 gm. (the crude product may be used), is then added to the whole of the hypochlorite solution and shaken till dissolved. The mixture is filtered, if necessary, placed in a large separating funnel, and acidified by the gradual addition of acetic acid (100 c.c.). Chloroform (about

100 c.c.) is then added to extract the dichloramin, and the whole is well shaken. The chloroform layer is tapped off, dried over calcium chlorid, filtered, and allowed to evaporate in the air. The residue is powdered, and dried *in vacuo*. It is sufficiently pure for most purposes without recrystallization.

The sodium toluene-parasulphochloramin, which is sold under the trade name of chlorazene, may be used instead of the toluene-parasulphonamid.

A Second Method of Preparing Dichloramin–T. Fifty gm. of para-toluenesulphonamid are dissolved in 500 c.c. of water, and 100 gm. of sodium acetate and 100 c.c. of chloroform are added. The container is immersed in cold water, and a rapid stream of chlorin is passed in until the mixture is saturated. The mixture is allowed to stand a few hours and, if the odor of chlorin disappears, more of the gas is passed in. If necessary, more chloroform can be added to dissolve the dichloramin. From this point the procedure is the same as in the preceding method.

Preparation of Chlorinated Eucalyptol. Eucalyptol (U. S. P.), not eucalyptus oil, must be used. Five hundred c.c. are treated with 15 gm. of potassium or sodium chlorate and 50 c.c. of concentrated hydrochloric acid. After twelve hours the oil is well washed with water and sodium carbonate solution. Dry sodium carbonate is added to the oil, and the mixture is allowed to stand twenty-four hours. It is then filtered and dried with a little calcium chlorid.

Preparation of Chlorinated Paraffin Oil. Five hundred c.c. of commercial liquid petrolatum are treated with 15 gm. of potassium or sodium chlorate and 50 c.c. of concentrated hydrochloric acid. The mixture is exposed to the light and allowed to stand overnight. It is then put into a separatory funnel, and washed successively with water, sodium carbonate solution, and water. The opalescent oil is tapped off, a lump or two of calcium chlorid and 5 gm. of charcoal are added, and the oil is filtered with suction.

In order to determine the amount of liquid petrolatum which can be added to the eucalyptol solution of dichloramin-T, the following mixtures were made:

Solution 1: 1 part liquid petrolatum to 2 parts 15 per cent. eucalyptol solution.

Solution 2: 1 part liquid petrolatum to 1 part 15 per cent. eucalyptol solution.

Solution 3: 3 parts liquid petrolatum to 5 parts 15 per cent. eucalyptol solution.

Solution 4: 2 parts liquid petrolatum to 1 part 15 per cent. eucalyptol solution.

These solutions were placed in test-tubes, stoppered tightly, and preserved in the refrigerator at about 0 C. All solutions became somewhat turbid as soon as the liquid petrolatum had been added, but in forty-eight hours there was no appreciable settling out in any case. After a week, however, the dichloramin-T had partially crystallized from solutions 3 and 4. Solutions 1 and 2 were no more turbid than just after the addition of the liquid petrolatum, and none of the dichloramin-T had crystallized out.

This experiment seems to justify the conclusion that no more than an equal part of liquid petrolatum should be added to a 15 per cent. solution of dichloramin-T in eucalyptol when the solution is to be kept for any length of time, but when the mixture is to be used immediately, as much as two parts of liquid petrolatum to one of the 15 per cent. eucalyptol solution may be used.

We have used a solution made up of one part of liquid petrolatum and two parts of 15 per cent. solution of the dichloramin-T in eucalyptol. A larger proportion of the liquid petrolatum would make the mixture somewhat cheaper, but would have no other apparent advantage.

One sample of chlorinated eucalyptol and two samples of chlorinated liquid petrolatum, one of which was chlorinated in the sunlight and the other on a cloudy day, were analyzed for chlorin by Carius' method with the following results:

Chlorinated eucalyptol:

0.1044 gm. oil gave 0.0044 gm. AgCl = 1.04 per cent. Cl.

Liquid petrolatum chlorinated on a cloudy day:

0.0936 gm. oil gave 0.0052 gm. AgCl = 1.37 per cent. Cl.

Liquid petrolatum chlorinated in sunlight:

0.151 gm. oil gave 0.0231 gm. AgCl = 3.78 per cent. Cl.

The amount of chlorin which the oils take up is not large, but the amount absorbed is equivalent to a very considerable portion of chlorin which would be available from a 10 per cent. solution of the dichloramin-T.

Conclusions. In comparing the practical surgical value of dichloramin-T with aqueous hypochlorite solutions in the treatment of infected wounds, which in spite of many serious objections has given such promising results, we believe that our laboratory and clinical findings thus far warrant the following statements:

1. Dichloramin-T is a non-irritating[1] synthetic germicide, and corresponds to the antiseptic chloramin substances found in minute quantities when active chlorin of the aqueous hypochlorite solutions is brought into contact with the exudate of suppurating wounds.

2. Dichloramin-T can be used in strengths of from twenty to forty times greater than is possible with the hypochlorites and in an oily solution which makes possible the slow diffusion of the germicide over a period of from eighteen to twenty-four hours, instead of a rapid disappearance in from thirty minutes to one hour as with the hypochlorites.

3. Its use is as simple as the application of the tincture of iodin, and we can see no reason why it cannot be used to replace iodin as a primary dressing. In our experience it is just as effective as a germicide, and is without the destructive effect on the tissue cells. We have had the opportunity of using it in this way at the primary operation in seven wounds involving soft tissues, tendons, joints and bones and have not failed to have primary union. One case, a compound fracture of a metacarpal with severed extensor tendons, did not receive treatment until three hours after the injury.

[1] We have seen two cases of skin irritation after several weeks of continuous use. It is similar to the eruption of ivy poison, and may be due to the eucalyptol.

4. The chlorin in dichloramin-T, as in the hypochlorites, has the power of dissolving dead tissues. Hemorrhage therefore must be stopped by ligation, else the clot will dissolve and secondary hemorrhage may follow.

5. One should not depend on a chemical agent to perform, in the treatment of suppurating wounds, that which can and should be done quickly and thoroughly by mechanical means. Neither chemistry nor bacteriology can or should be expected to replace the mechanics of surgery. At the best these chemical germicides can react only on the bacteria with which they actually come in contact, which means a very superficial process of infection. Therefore, at the primary operation all foci and devitalized tissues must be removed when possible by surgical procedures. Finally, adequate drainage, dependent if indicated, must be provided.

DISCUSSION

Dr. John B. Roberts, Philadelphia:

Dakin's solution has been used by me and others in the Polyclinic Hospital in Philadelphia, but recently we have been trying, as has Dr. Le Conte and his assistants, to get something that can be used with greater convenience than Dakin's sodium hypochlorite solution.

Dr. J. F. Schamberg has been experimenting in the laboratory for dermatological research, while making arsenobenzol with which to treat his syphilitic patients. He reported to the faculty three or four months ago that the chemists in this department had obtained a valuable antiseptic product derived from mercury and phenol. I have been using it in the wards and dispensaries in the proportion of 1 to 10,000 or 1 to 20,000 solution. It seems to be extremely satisfactory in arresting suppuration in wounds and preventing it in recent wounds; but the chances of testing it clinically have been small because I have not had many compound fractures this winter. It really seems to me that this product to which now they have given the name of mercurophen will prove to be more easy to manage than Dakin's, as it is perfectly stable when kept in solution and can be sent about the country in tablet form. This antiseptic is not yet on sale because Dr. Schamberg is as yet not sure how well it will act in the human animal. It is very much more germicidal than mercuric chloride and less toxic. Dr. Hugh Young has taken a large quantity of tablets to Europe and Dr. Schamberg will be very glad to supply surgeons with samples for experimental work wherever there is a demand. It seems to present valuable characteristics. We surgeons at the Philadelphia Polyclinic Hospital are now endeavoring to determine its clinical availability.

Dr. Walton Martin, New York City:

I would like to say a few words in regard to the Carrel method and Dakin's solution from my own experience in using it in infected wounds in a general hospital service during the past year. We may consider the method with advantage I think under three headings: (1) the principles of the wound preparation; (2) the solution and its administration; (3) the applicability of the method. The general advice to open infected wounds widely, to remove every bit of foreign material and necrotic tissue, to drain adequately every pocket, is in accord with surgical principles known for very many years. In the early part of the war gunshot wounds were treated as non-infected wounds, the wounds of entrance and exit were dressed. It soon began to be

generally recognized that this treatment was inefficient and that one was dealing with severely infected wounds and I think no one would differ from the advice given to open widely, to remove foreign material and drain sufficiently heavily infected wounds.

In regard to the solution we have all known the very strong antiseptic properties of a solution of chlorinated soda but its irritating qualities has limited its use; under the form suggested by Dakin this irritating property is very slight. It has seemed to me in using it to be the best antiseptic ever given to the surgical profession. Carrel has called attention to a very well recognized property of all antiseptics, that is, that they combine with proteid when applied and thus quickly lose their property of destroying bacteria; hence to be effective the antiseptic must be frequently renewed, and that the solution and the microörganisms must come into intimate contact.

Unfortunately it is obviously difficult and often impossible to apply all these principles. If one is treating an infected knee-joint with a fissured fracture of the femur, to drain every pocket, to bring the antiseptic in contact with every particle of infection does not seem to me easily carried out.

How much the good results are dependent on the general principle of wound preparation and how much on the antiseptic action of the fluid used remains to be seen. The great merit of Dr. Carrel's method seems to me to lie perhaps in the codification of well recognized and well-known surgical principles.

Dr. Charles H. Peck, New York City:

My experience is limited to a very few cases which I have treated by this method while on service at the Roosevelt Hospital. The first was so striking that I could not but be impressed. An oblique fracture of the femur was treated by Parham Martin bands and was infected. On the sixth day the wound was opened and flooded with pus. I was fortunate in having an intern trained in the use of this method and we applied the Carrel treatment. At the end of four days the suppuration had ceased and the wound surfaces and edges looked clean and granulated. We stopped treatment, expecting a possible recurrence of suppuration which, however, did not recur. The wound edges dropped together and in the course of three weeks the wound was completely and firmly healed. We allowed the case to go four or five weeks and then I operated to remove the band and there was no evidence of recurrence of suppuration near the bone or in any part of the old wound. That seemed a very striking result to obtain by the application of this treatment. I had a little later an extensive case of gas gangrene cellulitis starting in an ischiorectal abscess, extend-

ing from the abdomen to the umbilicus and to the axilla on one side, and that was opened freely and later the Carrel treatment was applied in the various incisions. I did not attribute the recovery of the case to the Carrel treatment but it cleaned up the sloughing wound most strikingly. We have had a few others in which the treatment was applicable and my feeling is that it is a method of sterilizing wounds far in advance of any former method. In speaking of it as flooding or flushing the wound I think that is against Dr. Carrel's advice, because a basic principle of the treatment is that you should not flush or flood a wound, but simply moisten every portion of the wound surface. One should moisten and spray all parts of the wound surface and if this is carried out I believe no one can fail to be impressed by the very great value of this treatment.

Dr. John Bapst Blake, Boston:

Dr. Gibson was good enough to come over and outline to us in Boston what he has spoken of here in more detail; we tried it at the Boston City Hospital, in which we have a large amount of unselected surgical material and the usual small number of hospital residents. Our conclusions were in line with his; that this is the best method of which we have any knowledge; that the detail is considerable, and in order that it should be ultimately applied in all hospitals, to be easily and faithfully applied, the method must be simplified. Our hospital pharmacist had no difficulty in making a satisfactory solution. After reading Dr. William O'Neill Sherman's article in *Surgery, Gynecology and Obstetrics*, I wrote him asking for reprints, saying that we had found the detail rather difficult on the whole, and the results were not quite what we had hoped. He wrote back that it was extremely simple and, to prove it, Carrel was coming back from France to teach it to American surgeons; a four week's attendance being required from all surgeons; evidently not so simple after all! Even in old chronic suppurations, if the details were followed, there is no question that in applying it even incompletely, it is superior to any method used in the Boston City Hospital. It is a very great addition to our therapeutic method, if the details are followed as given by Carrel.

Dr. Kenneth A. J. Mackenzie, Portland, Oregon:

I do not appear as a protagonist for any particular method of treatment of wounds, but nothing has been said in this discussion with reference to treatment by common salt, a method developed to a large degree in this war by Colonel Sir Almroth Wright. Dr. R. C. Matson, one of my young colleagues in Portland, has been ten months in his service working continuously in his laboratory, the only com-

plete one maintained on the French front, to work out in the most exhaustive way the problems of wound infection. In this laboratory both methods have been studied. According to Dr. Matson a showing made by the treatment of wounds with varying strengths of salt solution proved quite as good as those treated by the Dakin-Carrel method. It was found that salt acts as a lymphagogue and that its use favors the flow of liquids from the blood and the tissues in an outward direction thereby favoring drainage. In addition it releases an enzyme from the blood that has a digestive function which acts on tissues that are dead causing them to liquify and disappear. There are other important elements in the action of salt on wounds. It is one of the oldest remedies in wound treatment and its action as a most efficient preservative should be considered in relation to it. I am inclined to think that some consideration should be given to Wright's conclusions because of the extremely scientific manner in which he has developed, under ideal laboratory conditions, his method of treating wounds with solution of salt varying from the normal to the hypertonic salt solution.

Dr. Albert Vander Veer, Albany:

I feel somewhat embarrassed for I know the fault of old men who sometimes become over-garrulous. These papers to me make this impression, their precision, the thoroughness with which the conclusions have been worked out, employing methods that to us during the Civil War were entirely unknown, and how grateful we ought to feel to the men who have been working out their experiences and who now come to tell us of their results obtained in the treatment of wounded soldiers by presenting their papers to us from time to time. To go back to the war of 1862, after the battles around Richmond, the care of the soldiers in the large hospitals at that time was largely the opening of abscesses. Suppuration of every kind of wound took place. An attempt to save the knee-joint was an absolute failure. Resection of the elbow-joint sometimes resulted successfully but in the long bones frequently ended in amputation with the patient suffering from pyemia. Resections of the head of the humerus did well and I have seen useful arms resulting. I wonder if many of you who have seen the war of this period have met with the terrible prostrations that followed in these cases. I would like to speak of the treatment of wounds now and then. If I have a correct knowledge of wounds now, the old Minnie ball is comparable to the shrapnel of today, the small bullet used now is about like the one used during the Spanish-American War. After the Battle of Antietam and from that time on I think the military surgeons got on to the fact that they

must open wounds freely, lessening the number of abscesses that might form and treat the wound as an open wound. What did we have to treat the wound with? We had scraped lint. Women in those days were doing just what they are doing now: They scraped the lint that came to us and it was not until the last year of the Civil War we came into the possession of absorbent cotton. Of course, the scraped lint was clean and we dressed our wounds with that kind of a dressing. It was the duty of the hospital surgeon to get up as early as possible, depending on the number of patients, and dress wounds that were suppurating beyond anything I can describe to you. In the beginning of 1863, we had endorsed and sent to us from the Surgeon-General's office Labarraque's solution and were advised to use it in the proportion of 1 to 3 of water and really there was an improvement. We could notice this improvement: We dressed the wounds in the morning by the removal of all the pus saturated dressings and then poured into the wound this preparation of chlorinate of soda and these wounds did improve and finally we came to the point where the wound became a healthy one and could be brought together with bandages. We did not have at that time the rubber adhesive plaster of today but had to bring the edges of the wound together with compresses. We found our wounds did better and there was a lessening of suppuration. We even introduced a method of drop saturation of the dressings. These wounds had to be dressed two or three times in twenty-four hours. In the spring of 1863 the Army of the Potomac organized a system for the care of the wounded that was carried out thoroughly. The surgeons were appointed for picket line duty, got to the front with stretcher bearers and as soon as the men were wounded they brought them back to the field hospital. Here we took care of the men who were seriously wounded and bleeding first, others who had a less severe wound of the arm or leg with the hope of saving them. We did dress many of them in temporary splints and then sent them to the terminal hospital. We had to do a great many amputations early and late, and in doing so learned after a while to make good, free flaps because our amputations suppurated to the extent that the flap would shrink or atrophy very markedly on the margin. Our amputations did fairly well, but what saved them? We used silk in those days. We ligated our vessels with silk and we discovered that the more vessels we tied and the more silk we brought out at the end of the wound the better the cases did. It was a form of drainage and those conditions that were presented to us during the Civil War were treated in this fashion. These field hospitals had four operating tables, each table had one surgeon and three assistants. The hospital was made up in this way: One surgeon

was detailed to keep in touch with the quartermaster's department to see that he was well stocked with supplies, that his medical ambulance wagon was looked after, and in close touch with the rear. The battle would begin and soon the orders would come back—establish a field hospital for the first division of the second corps at a certain place and there take care of the wounded. Sometimes that hospital was captured and we always left with the wounded men our own surgeons to look after them. When the hospitals remained in our lines those of us in the care of the wounded remained there until every wounded man was taken care of. Sometimes it was twenty-four hours or forty-eight hours or even ten days before all of the patients were cared for. The organization of the base hospitals today and the work that is being done by the profession of America at the present time is entitled to the gratitude of this Nation because they show more patriotism and better preparations than any other class of men connected with our service.

Dr. Arthur D. Bevan, Chicago:

I think this is a tremendously important subject, but this idea has occurred to me that in analyzing it we should give to the different features that enter into it their proper relation if we can. It seems to me that in the handling of infected wounds the important things that would make up the great bulk of the 100 per cent. of total would be preparation of the wound, the removal of foreign bodies, the provision for drainage, and the use of some sort of moist dressing to maintain drainage. I believe that 90 per cent. of the value of the treatment of these wounds is embraced under these four heads, and then the question of the solution used would have 10 per cent. of value, whether it is normal salt solution, Dakin's solution, boric solution, or whatever we might use as compared to the total 100 per cent. of a comprehensive treatment and preparation of these wounds. I do not think we should forget the basic principles upon which wound-healing and the cleaning of wounds rests. When you have a wound of the hand with a swollen arm, with an infection traveling up to the axilla, it does not make much difference what sort of solution you use, and if at the point of infection you have a large opening of the wound and there is drainage a moist dressing of some kind is indicated. The clearing up of the infection from the wrist to the axilla would have nothing whatever to do with the character of the chemical used in the moist dressing, but depends entirely on the living processes in the tissues themselves. I think in studying a problem of this kind we should attempt to give the value to those factors in the procedure which really are responsible for the result.

Dr. Samuel J. Mixter, Boston:

One thing that applies to all sorts of surgical work is this: If we are going to try any new system which has been worked out carefully by a man of experience, we really ought to try his method before altering it or condemning it as Dr. Bevan has condemned the method in question. If you are going to try the Carrel method, try it. Then, if after weeks and months of trial you wish to modify it, do so. I remember in one of the large clinics in Europe hearing one of the greatest surgeons in the world talk for an hour about crushing a stone in the bladder proving absolutely that Bigelow was wrong. He then crushed the stone and before the operation was over his assistant, also one of the great surgeons, was standing astride the patient trying to pump fragments out with what we used to call a horse syringe. He had condemned untried a method that had been carefully worked out for months. We should, at least, follow instructions in trying a new procedure until we are thoroughly acquainted with the method; then, we can comment on the fallacies and experiment to improve.

Dr. Charles L. Gibson, New York City (in closing):

I realize in reading this paper that I am making only a fragmentary exhibition of certain phases. I read what I did in order to give a sample of the article. I have had the personal experience of having seen these things and it is impossible to give you my impression. Consider eighty compound fractures and not one of them suppurating. Every wound from shell and they would come all mangled up with wounds full of fragments of shell and pieces of clothing. In my visits to Depage's hospitals I stipulated that I should see every dressing myself. We dressed every one of these fractures: I can go a step further. I did not see one drop of pus in eighty fractures in Depage's service. Now there may be other methods just as good but you have got to show them to me to make me believe it. Depage is doing this method on a very large scale. Depage has an open mind and he is also trying out the Wright method. He was pleased with it but not sufficiently to give up the Carrel method. Take a compound fracture of the thigh, see the man at the start, the treatment instituted, no pus at any stage, the wound closed, and then take off the first dressing and pass your hand over that suture line and feel not a particle of infiltration, then you feel you are in the presence of something you never saw before. You have got to see this for yourself. Carrel realizes that the method is cumbersome and I believe in time he may bring out something in the way of what Dr. Le Conte has suggested. As soon as he can do that the method will be simplified.

I do object to people saying the Carrel method is no good when they do not know anything about it. That is the common criticism.

Dr. Robert G. Le Conte, Philadelphia (in closing):

The study was undertaken with a view to simplifying Carrel's method of using an aqueous hypochlorite solution, with its precise and painstaking technic; also to increase the strength of the germicide brought in contact with the wound, and to have that effect more lasting, so that the germicidal action would continue for a period of twenty-four hours, and also to decrease the discomfort of the patient.

LAMINECTOMY UNDER REGIONAL ANESTHESIA

By CHARLES H. FRAZIER, M.D., Sc.D.
PHILADELPHIA

Occasion arises in the performance of laminectomy, as it does in other operations, when the attending risk of the procedure may be materially affected by the employment of ether narcosis. Under such circumstances I have sought for methods of conducting the operation without ether and have attempted to apply to spinal operations methods of anesthesia induced by novocain that are applicable to other fields.

Of the clinical type to which I refer as demanding the use of every safety measure and the elimination of every risk, I may cite, by way of illustration, the case of a woman upward of sixty years of age who had been invalided for a number of years. Her weight was excessive, there had been evidence of cardiac decompensation and the phthalein test of renal function was alarmingly low. Altogether the patient's condition was not such as to warrant any large surgical undertaking without real apprehension, but as her life was rendered miserable by the spinal lesion from which she suffered, operation seemed urgent. Wishing to throw about her every safeguard, I decided to eliminate the influence of ether narcosis as a potential source of pneumonia or cardiac decompensation and carried out the operation, a laminectomy of the lower thoracic region, under novocain. In the course of the operation, which lasted an hour and a half, largely for its psychic influence, the anesthetizer was instructed to give inhalations of ether. Altogether two and a half ounces were employed but at all times the patient was conscious enough

to answer when spoken to and at the conclusion of the operation the pulse-rate was 72.

While regional anesthesia alone is mentioned in the title of this paper, it is desirable that one should be prepared to fall back upon certain supplemental measures, such for example as infiltration anesthesia, nitrous oxide anesthesia and later on the stovain block. To these we will subsequently refer.

In outlining a zone of anesthesia that followed a laminectomy and the division of four posterior spinal roots on the right side for the relief of pain, I observed a band of anesthesia of the left side of the median line of the back. This band corresponded in length to the number of laminæ that had been removed and was about 5 cm. wide. The thought at once occurred to me that in the performance of the laminectomy I had destroyed the sensory innervation of the structures invaded in this operation and that if the nerve supply could be reached with the needle, a means was at hand whereby the principles of regional anesthesia might be applied to this territory. From anatomical reference works I found the nerve supply of the structures under consideration to be as follows: After its exit from the intervertebral foramen the intercostal nerve divides into two main branches. The posterior primary divisions of the spinal nerves arise either as a single cord from the trunk formed by the union of the two roots or as two separate strands from the roots themselves. They turn dorsally almost immediately and divide into an internal (r. medialis) and an external (r. lateralis) branch which supply the dorsal muscles and integument. Down to and including the 6th thoracic nerve the internal branches are mainly cutaneous and the external entirely muscular. From the 7th thoracic down the reverse condition exists (Piersol).

As the latter branch, the *rami posterus lateralis*, supplies the structures that are invaded in a laminectomy, the question arose as to whether it was feasible to inject this branch with reasonable accuracy. For various anatomical reasons it became evident that a more practical solution of the problem was the injection of the parent trunk, the intercostal nerve. On a pre-

ceding occasion my interest in the technic of injecting the intercostal nerves had been aroused in connection with the treatment of severe and intractable forms of intercostal neuralgia with alcoholic injections. I had directed Dr. W. A. Sawyer, at the time a member of my staff, in an anatomical investigation on the feasibility of the injection of the intercostal nerves. The method which he elaborated is that which I have adopted.

To put this method into practice one must be familiar with certain anatomical relationships. To orientate the intervertebral foramen the midpoint between the transverse processes serves as the guide. The interval between the transverse processes has been estimated as 2.9 cm. to the right or left of the median line. The location of the intertransverse spaces must be determined in the thoracic region by palpation, although in the lumbar region the tip of the spinous process is a little above the lower border of the transverse process of the corresponding vertebra. But in the thoracic region, having determined the location of one intertransverse process, the location of those above or below is not difficult since the distance between them is represented as 2.5 cm. and is fairly uniform. With regard to the depth to which the needle be inserted, the intervertebral foramen should be reached at a distance of 3 cm. in the upper thoracic and 4 cm. in the lower thoracic and lumbar regions. These measurements coincide with those published by Allen.

A matter of real import in the technic of injection is the direction in which the needle must be inserted. If the needle be inserted at an angle with the vertical midline of less than 45 degrees, the needle may pass through the intervertebral foramen and on into the cord substance. On the other hand, if the needle be directed at an angle precisely of 45 degrees or a little less the danger is averted. As an additional guide Sawyer found that the needle should be directed at an angle of 35 degrees to the cutaneous surface. To determine these angles measurements may be made with the aid of a protractor.

Preliminary to the operation morphin sulphate, gr. $\frac{1}{6}$, and scopolamin, gr. $\frac{1}{200}$, are given hypodermically, and if necessary

$\frac{1}{8}$ grain of morphin may be given during the operation. With the patient in position a vertical line is drawn corresponding to the line of the spinous processes. Parallel to this median line are drawn two vertical lines 2.9 cm. to either side, and at a point corresponding to the space between the transverse processes a transverse line is projected at right angles to the midline.

The intersection of the transverse and lateral vertical lines marks the points at which the needle is introduced. After the location of the first intertransverse space has been identified by the successful injection of one nerve, as many more transverse lines are projected as there are nerves to be injected at a distance of 2.5 cm. above or below the first point of injection. Here, again, the intersection of transverse and vertical lines marks the points of successive injection.

With these topographical landmarks the surgeon proceeds with the injection, provided with a solution of 0.5 novocain, a hypodermic needle, one platinum needle, a Record syringe, a centimeter scale and protractor. The skin and subcutaneous tissues are infiltrated with the novocain solution and the platinum needle is then introduced at the proper angle, that is, at an angle of 45 degrees or a little less to the vertical midline and of 35 degrees with the cutaneous surface. The distance to which the needle must be advanced will vary according to whether the individual be lean or stout. On the average the distance to the nerve in the upper thoracic is 3 cm. and in the lower thoracic or lumbar regions 4 cm. When the needle comes in contact with the nerve the patient will at first experience a sharp pain, referred to the terminal distribution of the nerve, soon allayed by the injection of a few drops of the solution. At each injection 5 to 10 c.c. are used, according to whether the injection is made directly into the nerve or about it. In the average case, where four laminæ are to be removed, it will be necessary to inject four right and four left intercostal nerves, using as a maximum but 80 c.c. of a 0.5 per cent. solution.

Doubt may arise in the minds of some as to the possible toxic effects of the drug should the solution penetrate the dural

sac. With this in mind, Sawyer in his observations on the cadaver injected an alcoholic solution of methylene blue with a hypodermic needle directly into the nerve root, but on no occasion was a trace of the stained fluid found either within the dural sac or the cord, and he concluded, therefore, that the possible danger of the fluid reaching the cord directly or indirectly was remote. However, this question of the relative toxicity of paravertebral and subcutaneous injections has occurred to others and has been made the subject of experimental investigation, notably by Muraya. Using a novocain solution stained with methylene blue the latter discovered the dye in the urine ten to twenty minutes after subcutaneous, and five to ten minutes after paravertebral, injections. To safeguard the individual Muraya proposes a solution with adrenalin to delay absorption and a 5 per cent. gelatin-saline solution to delay diffusion. Although I have not as yet used this solution it appeals to me as having merit and well worthy of trial.

As with regional anesthesia elsewhere, owing to anatomical variations and other considerations, the degree of anesthesia may not be complete enough in all cases to conduct the operation throughout without pain. Under such circumstances supplemental injections of novocain solution may be made, especially in the removal of the spinous processes and laminæ when the needle is introduced directly into the periosteum. Or if need be at this stage for a few moments one may resort to nitrous oxide anesthesia.

After the spinal canal has been opened subsequent manipulations may require resource to other methods of anesthesia according to the object to be attained. For example, in the removal of tumors attached to the roots or in division of the posterior roots, some method must be adopted of controlling or inhibiting pain, and for this purpose I have resorted to the application of stovain on a pledget of cotton. The use of stovain in this way was introduced in my clinic many years ago for an entirely different purpose. Impressed with the fact that manipulation of the posterior roots is an important factor in the production of

shock, I searched for a measure of prevention and, partly from clinical and partly from experimental observations concluded that the "stovain block" offered the best protection. A thin pledget of cotton is moistened with a 0.4 per cent. solution of stovain and brought in contact with cord and roots at the level of operation.

Regional anesthesia is appropriate chiefly for operations in the thoracic region. While the method of paravertebral anesthesia has been applied by Braun in the cervical region, the proximity of the phrenic center to the level of injection at least arouses one's apprehension as to the safety of the practice and for this reason I have purposely avoided it. Infiltration anesthesia serves as an excellent substitute for regional anesthesia in the cervical segment and I found it perfectly feasible in a patient who because of pulmonary tuberculosis, seemed an unfit subject for ether narcosis. Four laminæ were removed and the inspection of the several aspects of the cord was accomplished without discomfort to the patient. Throughout the operation the patient complained of pain only when the posterior roots were disturbed and had I been familiar at that time with the use of the stovain block every step of the operation could have been made painless.

When called upon to perform a laminectomy in the lumbar region spinal anesthesia is the method of choice because it is equally if not more effective and the technic less complicated. With one insertion of the needle one accomplishes what is difficult in the regional method with eight to ten. The first resection of the posterior roots for spasticity in my clinic was carried out under spinal anesthesia, and because of the necessary manipulation of the roots this form of anesthesia proved particularly appropriate.

In addition to the examples already cited, where I have found it desirable to avoid ether narcosis, there should be included injuries to the cervical cord. As the accompanying paralysis of the accessory muscles of respiration predisposes the patient to pulmonary congestion, the use of ether is properly

looked upon as injudicious, and it is quite feasible to perform an exploratory laminectomy without it.

My purpose in discussing methods of anesthesia other than those usually in vogue has been chiefly to point to ways of reducing such risks as there may be attached to operations upon the spine. By attention to such details the mortality has been so reduced that an exploratory laminectomy *per se* has no more attending dangers than an exploratory laparotomy. All told there have been but four operative deaths in my clinic following laminectomy, and two of these could not be charged against the operation—one, an acute osteomyelitis of the spine in a profoundly septic patient; the other, a grave injury to the cervical cord. Of the two remaining deaths one followed resection of the posterior roots in a defective child of five, the other in an adult.

There are points to be observed other than the selection of the anesthetic to which I briefly allude in closing: an ample exposure, implying the removal in the first instance of an adequate number of laminæ; *x*-ray identification of at least one lamina before the operation, so that the opening corresponds precisely to the location of the lesion; coffer-damming with cotton the spaces on either side of the dural flaps to prevent drops of blood gaining access to the dural sac, a potential factor of postoperative adhesions; the gentlest manipulation of the cord or roots and the "stovain block" as prophylactic against shock; minute closure of the dural incision with fine needles and silk to prevent the escape of cerebrospinal fluid; and careful juxtaposition of each layer—muscle, muscle sheath, and intervertebral aponeurosis, together with superficial fascia—to ensure maintenance of function and the avoidance of disability after the removal of spines and laminæ. Observing these essential features the performance of a laminectomy may be resorted to with anticipation of the patient's recovery in all but exceptional instances.

REGIONAL ANESTHESIA IN EXTRAPLEURAL THORACOPLASTY AND SOME INTRA-THORACIC OPERATIONS

By WILLY MEYER, M.D.
NEW YORK

Whoever has followed the trend of events as regards the production of analgesia must have been impressed by the fact that abroad the tendency of surgeons has been to become emancipated from general anesthesia in their daily work, as much as possible, whereas the majority of American surgeons have faithfully worked for years to improve and safeguard general anesthesia.

Only a few surgeons here have employed regional anesthesia on a larger scale within the last few years. That it must be an advantage to the patient not to have taken an anesthetic needs no discussion. Whenever the main nerve trunks that feed the operative field can be reached with safety, regional anesthesia is feasible. All that is necessary on the part of the surgeon is practical experience and some patience, as well as the time to wait until the fluid that produces the analgesia has taken effect.

It is important to remember that it is not a matter of necessity to have the needle strike the nerve trunk itself, although this is naturally most effective and, usually, harmless, but that the "perineural infiltration," that is to say, the injection of the analgesic fluid into the tissues surrounding the nerve, suffices to block it. We know that 60 to 70 per cent. of all operations

can nowadays be carried out under regional and local anesthesia. On my division at the German Hospital it has been practised for many years.

The surgeon's principal reason for not using this splendid method more often is lack of time. One *has* to *wait* until the injected fluid has taken effect, and it takes ten to twenty minutes. It is absolutely necessary to wait this long in major operations in which the work involves a larger area. In the more localized operations, such as, for instance, thyroidectomy, suprapubic cystotomy, etc., a few minutes are sufficient to produce the desired effect. If the surgeon has to, or wants to, carry out the injection of the analgesic fluid himself, he will do well to first attend to the infiltration, after disinfection of that portion of the skin where the injection has to be made, and then get himself and the patient ready for the operation. In our general hospitals it would seem to be in the interest of the work to have one man, *e. g.*, one of the assistant adjuncts, become expert in regional anesthesia and then have him permanently assist in all these operations. He should "start the next case," same as we now are wont to have the anesthetist start the next general anesthesia.

There certainly is no region of the body more favorable for the application of regional anesthesia than the thoracic portion and particularly the *chest wall*, for there are the twelve pairs of thoracic nerves which feed it and can be reached with comparative ease and safety. But also some intrathoracic operations can be well done without general anesthesia. Only the virgin pleura, when divided on opening the pleural cavity, usually answers with such tremendous reflexes that a few whiffs of an anesthetic become necessary at this time. Later on a drop of an anesthetic, administered now and then, suffices to enable the surgeon to do his work. An inflamed and thickened pleura stands handling very well under regional anesthesia.

An anesthetist certainly must be at the helm. Many patients are extremely nervous and irritable. Some will simply refuse the operation unless they "can be put to sleep." In such cases

we have conducted a sham inhalation anesthesia with a solution of one-half alcohol and one-half water, or exceptionally, have had a few drops of chloroform or anesthol administered, not enough to cause the patient to completely lose consciousness.

Regarding my own experience with regional anesthesia in thoracic surgery, I have used it in cases of empyema and of lung abscess, in ligation of branches of the pulmonary artery, and particularly in extrapleural thoracoplasty. The latter term has been given to the operation of multiple rib resection, done in cases demanding compression of the affected side of the chest. The troubles that come into consideration in this respect are chronic suppurative inflammation of one or more lobes of the lung, of tuberculous or non-tuberculous character. As to the latter class, patients suffering from bronchiectasis have been subjected to the operation, mainly after branches of the pulmonary artery had been tied at a previous sitting for the purpose of producing shrinkage and carnification of the lung parenchyma by connective-tissue proliferation, after the lung had been thus deprived of its physiological function (Sauerbruch-Bruns). In some instances I have also tried the effect of the operation without this preliminary procedure. In tuberculous patients the indication for extrapleural thoracoplasty has been established in the presence of cavity formation within the upper lobe, if compression by means of air or nitrogen insufflation into the pleural cavity had become impossible on account of adhesions that had formed between pulmonary and costal pleura, and hygienic medical regime had ceased to be of benefit.

So far as extrapleural thoracoplasty in bronchiectatics is concerned—to which class of patients my own experience with the operation so far has been confined—I hardly believe that it will be often resorted to nowadays. The evolution of the surgery of this chapter certainly points in this direction. Experience so far gathered has shown that, even with the preliminary ligation of the feeding branch of the pulmonary artery, the operation will but improve the disease—rarely cure it. Earlier cases of bronchiectasis in which all the lobes of one

lung are affected seem to yield to methodical irrigation of the bronchial system of the affected lung with antiseptic fluids. When confined to one lobe alone pneumotomy with prolonged drainage will sometimes bring the desired result; a persistent bronchial fistula can be closed by a secondary operation later. In more advanced cases the excision of the affected lobe will have to be done in one or more stages. A number of surgeons, particularly in this country, are now hard at work trying to find ways and means of lessening the dangers of this operation. Hence, typical extrapleural thoracoplasty will at present come into consideration principally in cases of advanced pulmonary tuberculosis which are beyond help from the milder procedures and would be left to die if the bloody operation were not resorted to.

For the sake of completeness I will mention that we have three methods of extrapleural thoracoplasty, that of Friedrich, Sauerbruch and Wilms.

Friedrich, at the suggestion of Brauer—both then holding positions at the University of Marburg—raised the scapula with the help of the typical Schede incision (Fig. 1), with the patient under a *very* superficial chloroform anesthesia. The tenth rib up to the second, or also including the first, were then resected subperiosteally in their entire length. On account of its magnitude and frequent deleterious effect upon the heart action in these weak and reduced patients, this method was soon abandoned. Sauerbruch then proposed the two-stage operation. He insists that it is of importance in weak patients with reduced power of expectoration, first to compress the lower lobe with the help of thoracoplasty, in order to avoid aspiration pneumonia of this lobe from the cavity formation within the upper lobe. For this purpose he resects the fifth to the tenth, or the sixth to the tenth ribs inclusive, at the first stage. At the second stage, following in about two weeks, the upper four or five ribs with or without a portion of the clavicle are cut out. Only if the patient seems to have considerable power of resistance the greater part of the first to the tenth rib may be removed at once. He uses the so-called posterior hook incision, a cut that

represents the posterior half of the Schede incision (Figs. 2 and 3). In all his operations he employs regional and local novocaine anesthesia.

FIG. 1.—Schede's incision, raising a skin muscle flap including scapula, exposing the entire length of the first to tenth ribs.

FIG. 2.—Sauerbruch's "hook incision," representing the posterior half of Schede's incision.

FIG. 3.—Exposure of the posterior two-thirds of the ribs by means of the "hook incision," the inner border of the scapula being pulled outwardly.

Wilms does not attach any particular importance to the primary compression of the lower lobe, but attacks at once the upper ribs. He also prefers to operate in stages and favors

the so-called "columnar resection," posteriorly as well as anteriorly, leaving the middle portion of the ribs in place (Fig. 4, *B*,

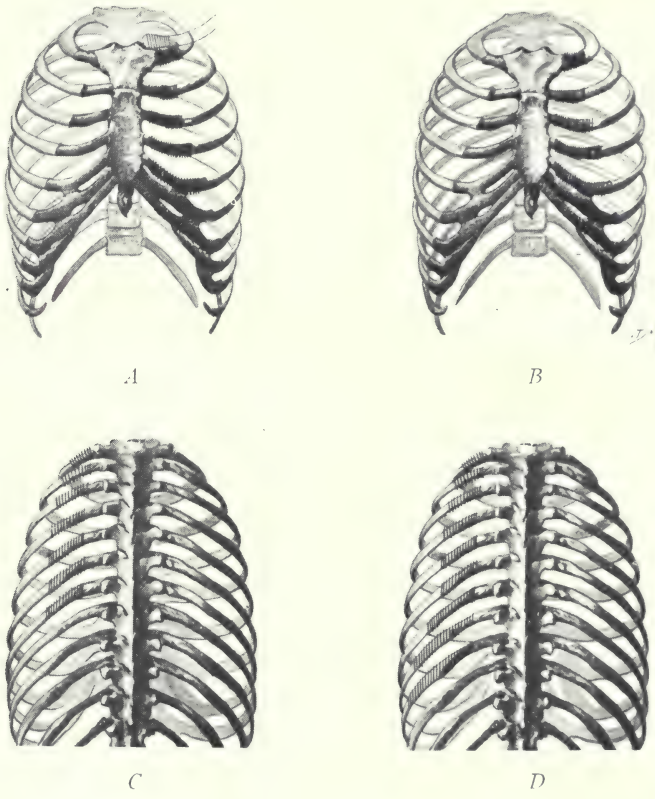

FIG. 4.—Illustrating Wilm's "columnar resection" of the ribs. (From Münch. med. Wchnschr., 1913, pp. 450 and 451.) *A*, resection of the cartilages plus adjacent portions of the upper five ribs, also of the sternal extremity of the clavicle, in order to increase the contemplated compression of the diseased lung. *B*, same as in *A*, without the additional operation on the clavicle. *C*, resection of the upper seven ribs in the region of their angle. *D*, same as in *C*, operation involving the nine upper ribs. Note the increasing length of the resected portion of seventh to ninth ribs.

C, *D*). In advanced cases of upper lobe cavity formation the sternal portion of the clavicle is included in the resection in

order to increase the compression (Fig. 4, *A*). Wilms also works with regional and local anesthesia.

It stands to reason that it must be of great advantage to these patients if the operation can be carried out under regional anesthesia. They thus remain able to expectorate at will, and have their mouths free and unincumbered. The ever-threatening aspiration pneumonia is thereby reduced to a minimum.

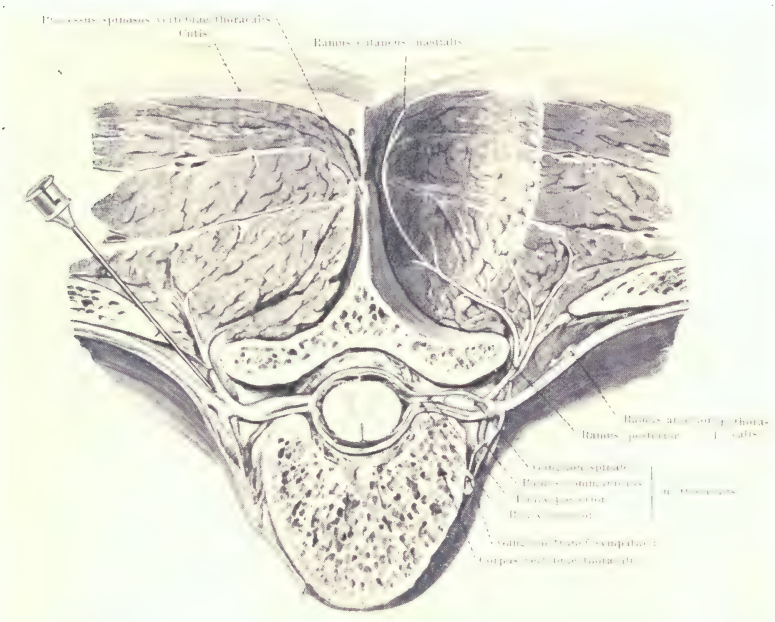

FIG. 5.—Transverse cut through dorsal spine with muscles of back. The needle has been added by author in order to point to the efficiency of this regional anesthesia if the method is carried out correctly. (From Spalteholz. "Handatlas der Anatomie des Menschen," vol. iii, Fig. 690.)

SENSORY INNERVATION OF THE THORACIC WALL. The sensation of the thoracic wall on either side is controlled by the twelve thoracic nerves. The first of these leave the intervertebral foramen between the first and second dorsal vertebræ, the twelfth between the twelfth dorsal and the first lumbar vertebræ. Immediately after they have made their exit from the spinal

column, they divide into a stronger anterior and a weaker posterior branch (Fig. 5). Both are mixed nerves, viz., they carry motor and sensory bundles. The anterior branch communicates with the sympathetic ganglion (Fig. 6), enters into anastomosis with its neighbors (ansæ or plexus), and innervates the broad muscles of the back. The posterior branch also anastomoses with its neighbors and innervates the long dorsal muscles and the skin of the back.

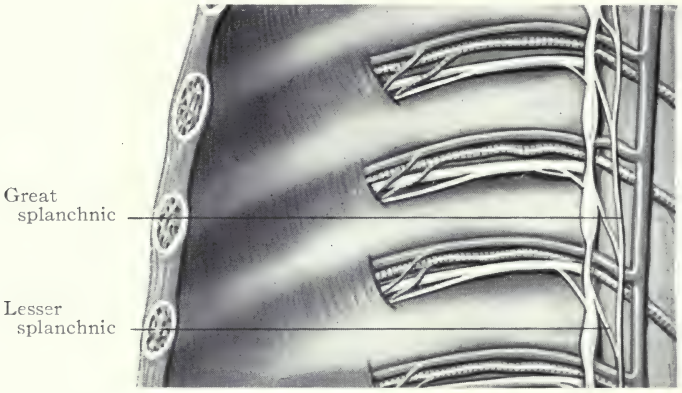

FIG. 6.—Showing anastomosis between the intercostal nerves and the thoracic portion of the sympathicus and its ganglia. (From Heitzmann, "Handatlas.")

The anterior branches run in the intercostal space as "intercostal nerves." Each of these gives off to the chest wall a nervus cutaneus lateralis, which subdivide again into anterior and posterior branches ("nervi cutanei laterales pectoris anteriores et posteriores"). Of the *upper* six thoracic nerves the anterior branches of these lateral nerves innervate the skin of the mammary gland and the gland itself; the posterior branches provide sensation to the skin of the back. Of the *inferior* six lateral cutaneous nerves the anterior branches run to the skin of the anterior abdominal wall, the posterior branches to the skin of the back ("nervi cutanei laterales abdominis anteriores et posteriores"). The intercostal nerves, after having given off

the lateral cutaneous branches of the chest, feed the intercostal muscles. At the border of the sternum they perforate the major pectoral muscle and terminate as "nervi cutanei anteriores" in the skin of the anterior aspect of the breast.

INSTRUMENTS. A syringe to which the needle can be firmly attached by a bayonet-arrangement (Fig. 7, *a*) or by a special design (bit-clutch) (Fig. 7, *b*) is preferable to the well-known Record syringe. The latter lacks the firm unison with the needle; besides, it works hard and affords no support to the surgeon's second and middle fingers during injection of the fluid. The needle must be fine and of sufficient length (6 inches).

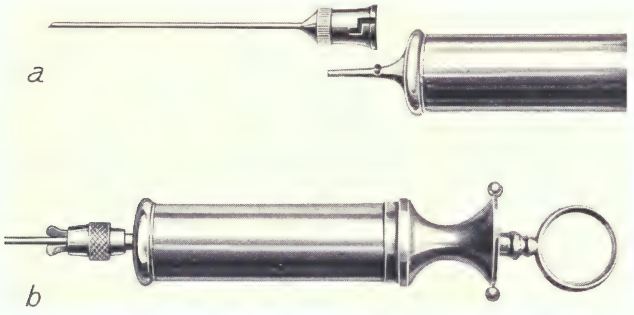

FIG. 7.—*a*, Record syringe with a metal knob at nozzle. The needle shows the notch of bayonet attachment, making both parts a firm unit. *b*, Heynemann's all-metal syringe for local and regional anesthesia, holding needle with bit-clutch arrangement.

SOLUTION. A 0.5 per cent. solution of novocain with suprarenin is usually efficient. A strength exceeding 1 per cent. is inadvisable; 100 to 200 c.c. (about 3 to 7 ounces) may be required. If sufficient time is allowed to elapse between injection and start of operation (about fifteen to twenty minutes), the analgesia will in most instances be satisfactory. If the patient reacts, a very few drops of an anesthetic will quiet him. The hypodermic injection of morphin, or pantopon (0.5 grain), one hour before the beginning of the operation, is of great assistance.

Whether the additional hypodermic administration of scopolamin is advisable I am not prepared to state as yet. We have seen most satisfactory results from this combination in all kinds of major operations. Perhaps it will prove equally beneficial in thoracic cases. The reason that I have not tried it has been that I feared it might not leave the patient sufficient self-control to cough and expectorate. If it were determined that this fear was unfounded, a hypodermic of scopolamin might be added with advantage also in these cases.

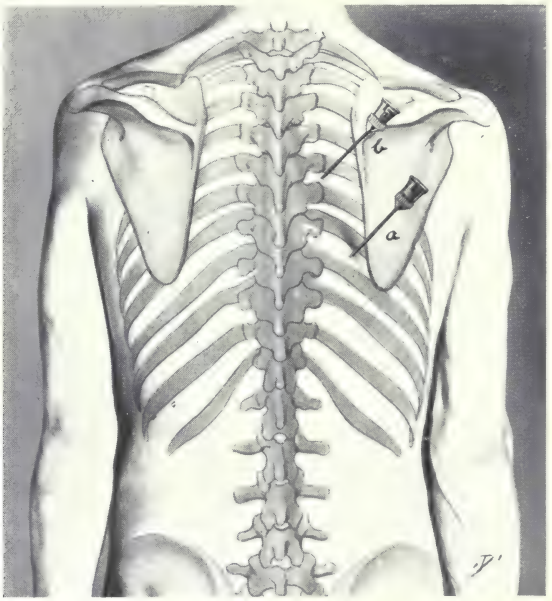

FIG. 8.—Diagrammatic, illustrating the location where the needle is introduced in Schumacher's (*a*) and Kappis's (*b*) methods. In practice the needle at *a* has to point upward and outward and run close to the rib.

TECHNIC. There are two good methods at our disposal. One was worked out at the Zurich Clinic (Sauerbruch), and published by the late Schumacher; the other is practised at the Kiel Clinic (Anschuetz), and was published by Kappis. Both appeared in print at the same time (*Centralbl. f. Chir.*, 1912, No. 8, pp. 249 and 252).

In the first method the nerve is reached at the angle of the rib (Fig. 8, *a*), in the second it is reached proximally to this location, viz., anteriorly and inwardly from the angle (Fig. 8, *b*). Here the thoracic nerve with all its branches can be infiltrated. The technic of the Kiel procedure is more difficult. In carrying it out the needle must strike the rib at or near its articulation with the transverse process of the vertebra. The location of this articulation is usually found 3.5 cm. ($1\frac{3}{8}$ inches) to the left or right of the median line. The difficulty is, that, because of the rib running forward and inward of this place, one cannot palpate its proximal extremity through the bellies of the thick muscles near the spine. However, even in stout individuals one of the lower ribs usually can be made out somewhere in the back. If the lower border of this rib is projected in the direction of the same medially, the point of entrance for the needle is found at the spot where this projection line crosses a perpendicular line drawn parallel to and 3.5 cm. to one side of the median line, viz.: the spinous processes (Fig. 9). The next lower border of a rib above or below is about 3 cm. ($1\frac{3}{16}$ inches) distant. In order to facilitate the work of finding the respective point of entrance at the subsequent ribs I had a flexible (sterilizable) tape-like metal strip made, with a 3 cm. scale on one side and a 2.5 cm. scale on the other (Fig. 9, *A*). This has been found a useful addition to our instrumentarium.

After the respective number of the palpable lower rib in the back has been ascertained all one has to do is to count the markings on the scale upward and find the top rib that is wanted. From here the operator will then proceed downward with the infiltration from rib to rib, as many as have been slated for resection. Or, if the lower rib, the number of which has been made out, lies within the operating field, one can commence infiltrating the thoracic nerve of this rib and then advance upward, step by step, at 2.5 to 3 cm. distance. It seems best to commence with the lower rib and work from below upward.

Of course, this distance of 3 or 2.5 cm. is not found correct in

every instance. It varies with the size of the patient. Still, as an average, the marked distances have been a welcome aid. In order to be on the safe side, the thoracic nerve of the two ribs beyond the field of thoracoplasty, above as well as below, are included in the blocking.

FIG. 9.—Illustrates Kappis's method of regional anesthesia in thoracic operations, with the patient in the sitting posture. *A*, the sterilizable metal tape divided by 2½ and 3 cm.

For both methods the patient lies on the operating table, best on his stomach, with his head close to the upper end, and both arms hanging down perpendicularly (Fig. 10). A sand-bag or

other round pillow supports the abdomen to overcome the lordosis. After proper disinfection and iodinization of the entire back, regional anesthesia is started.

If the Zurich procedure is chosen, the line of the paravertebral skin incision (Fig. 2) is anesthetized first and *within this* line the needle is painlessly introduced. The latter is advanced from below and inward in an upward and outward direction toward the angle of the rib above. When the grating sensa-

FIG. 10.—The same as Fig. 9 with the patient in the abdominal posture, lying horizontally on the operating table. (In the picture the table has been tilted in order to allow the artist to photograph the entrance of the needle in the back.)

tion is felt, 1 to 2 c.c. of the fluid are deposited. The needle tip then finds the lower border of the rib, where 5 to 8 c.c. are injected. About 10 c.c. in all are used. The same procedure is then repeated with each successive rib.

If the Kiel method is used one of the lower ribs is carefully palpated and now the first point of entrance located as just described. The point of puncture is first frozen with the ethyl chloride spray. The operator's nail marks the place for freezing

the skin. As soon as the spot has turned white the needle is pushed through the skin and conducted slowly down in a straight sagittal line until it touches the bone. In the average case the distance from the skin to the rib measures about 4 or 5 cm. ($1\frac{1}{2}$ or 2 inches). The scratch of the needle's tip on the bone must be clearly felt. Now the operator searches with the needle for the lower border of the bone and then pushes it gently forward in a slightly inward direction toward the spine for about 1.5 cm. ($\frac{3}{4}$ inch) (Figs. 5, 9 and 10). At various depths the fluid, 8 to 10 c.c. in all, is injected. In this process the nerves most likely often are hit and their substance directly imbibes the novocain solution. But this leaves no deleterious effect. Step by step, with the same technic and continued care, the respective ribs are treated. One must remember that when attending to the upper ribs, the increasing thickness of overlying soft tissues makes the needle sometimes pass to a depth of nearly 5 or 6 cm. ($2\frac{1}{2}$ inches), before it strikes the bone. When the last rib above—according to previous determination—has been attended to, it is necessary to wait for fifteen to twenty minutes before starting to make the incision—*the* important point which I would like to particularly emphasize once more. The mistake we all are prone to make—thereby depriving ourselves and the patient from reaping the full benefit of the regional anesthesia—is, that, owing to lack of time, we cut down these minutes.

Complications, such as puncturing bloodvessels or the lung, have not been observed. Neither method appears to be connected with danger to the patient. Kappis has seen that when the needle pricked the pleura, the patient suddenly began to cough. He withdrew the needle somewhat, giving it a different direction, and no harm resulted.

The strength of the solution should be 0.5 per cent. This was used at Zurich with satisfactory results. Kappis employed a 1 to 1.5 per cent. solution but states that he intends to reduce the strength. In one of my cases a most profound collapse occurred after liberal use of a 1 per cent. novocain solution, about 80 to 100 c.c. The operation (thoracoplasty on a bron-

chiectatic) had to be postponed. Six days later the 0.5 per cent. solution, applied in the same manner, gave a satisfactory result.

I have so far practised Kappis's method only; this for the reason that it appealed to me as anatomically particularly efficient. However, I shall not fail to try Schumacher's method as soon as an opportunity presents itself. The analgesia derived from the latter has been lauded by many colleagues who had a chance of seeing it carried out. The amount deposited at each rib is about 10 c.c. in both methods, as stated above.

My cases of extrapleural thoracoplasty done under regional anesthesia, seven in number, were all bronchiectatics. The operations were done at a time when I tried the effect of this procedure in advanced, non-tuberculous suppurative affections of the lung; in three of them branches of the pulmonary artery had been ligated at the first stage. I have been much pleased with the working of the anesthesia; now and then a few whiffs of an anesthetic were required, especially in reduced nervous individuals.

In one case, a thoracoplasty requiring resection of the first to the tenth rib, an ideal regional anesthesia—without the addition of any inhalation—was obtained, the patient conversing during the entire operation, never once complaining of pain.

Extrapleural thoracoplasty for advanced pulmonary tuberculosis—the real field for this operation—I have not been able to carry out so far, owing to the impossibility of getting such patients admitted to the hospitals with which I am connected. All my efforts in this direction within the last five years were thwarted. However, I am glad to be able to add that it is now planned at the German Hospital to have two rooms in the Thoracic Pavilion set aside for this class of patients.

The fact that more than 66 per cent. of these otherwise entirely hopeless cases have been greatly improved or cured at the hands of surgeons abroad by such compression from without, with the help of thoracoplasty, should serve us as a stimulus to find ways and means by which it may become possible to afford patients of this type the opportunity of bene-

fiting by operative procedure, thus saving at least a number of them from certain death.

Regional anesthesia has been successfully applied by me so far in only one patient with advanced pulmonary tuberculosis with cavity formation in the left upper lobe, on whom I performed Tuffier's operation. Here, after resection of a piece of the third rib in the anterior axillary line and division of the posterior lamella of the rib periosteum plus endothoracic fascia, the costal pleura was gently pushed off the chest wall, including the apex of the lung, and then a paraffin plumb introduced.

The same method of regional anesthesia has been many times carried out in single or multiple rib resection for empyema, in pneumotomy for lung abscess, exploratory thoracotomy for lung tumor and for ligation of a branch of the pulmonary artery. In one of the latter cases the patient, an intelligent young man, was conscious during the entire operation. Only at the time of opening his pleural cavity, which showed no signs of chronic inflammation, a small amount of an anesthetic had to be administered.

There can be no doubt that regional anesthesia represents a great asset in the successful performance of extrapleural thoracoplasty as well as in some intrathoracic operations.

REGIONAL ANESTHESIA, OR NERVE-BLOCKING

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THE subject of regional anesthesia, or nerve-blocking, may be taken up under three heads: (1) the mechanical; (2) physio-chemical; (3) physiological. Under the mechanics are to be considered the instruments used, the method of using them, the anatomy of the parts involved, etc. The most important part of the injecting apparatus is a number of well-made, fine needles, from 8 to 15 c.c. in length. They should be rigid enough to enable one to recognize the various tissue-layers through which the needle passes, but they should not be so highly tempered as to break easily. Any good 10 or 20 c.c. record, or Luer syringe, answers the purpose. Naturally, in nerve-blocking an intimate knowledge of anatomy is essential, not simply descriptive anatomy, but what may be called perspective anatomy. To block nerves successfully one must be able not only to visualize the course of the nerve on the surface of the body, but also must be able to perceive the depth of the nerve from the surface. It requires practice to enable one always to deposit the anesthetizing fluid in contact with the nerve trunk, and when one fails to get anesthesia, it is due to the fact that the fluid had failed to reach the right spot. In order to accomplish this, one must know just where the point of the needle is; in other words, one must be able to see with the mind's eye the exact location of the needle point, and this, if I may be allowed the expression, is the trick of successful nerve-blocking. Fortunately, nerve trunks are quite regular in their location, yet, notwithstanding this, it is

not always easy to place the point of the needle close enough to the nerve so that the fluid will come in direct contact with it. A nerve may lie just beneath a layer of fascia, and this fascia may be just enough to prevent the fluid from coming in contact with the nerve. Such is the case, for example, with the anterior crural nerve; it is not only necessary for the point of the needle to be beneath the fascia lata, but also beneath another thin layer of fascia which separates the nerve from the artery; and if the fluid is not deposited beneath this layer, it will spread above it and thus not come in direct contact with the nerve; hence, a good anesthesia will not be obtained. It is interesting and instructive to observe the influence of the fasciæ on the distribution of injected fluids by injecting colored fluids into cadavers. Experience and a delicate touch will, as a rule, enable one to recognize the various layers as they are reached by the needle. Lateral movement of the needle back and forth as it is being introduced aids one greatly in recognizing the fascia, as the point of the needle can be felt scratching the fascia when it comes in contact with it. The recognition of a mixed nerve, such as the anterior crural, sciatic, brachial plexus, etc., is much facilitated by the use of a mild electric current and an insulated needle. For this purpose I have found a small toy dynamo of great value. It has the advantage not only of being cheap but of being always ready and in good working order. One electrode is placed in contact with the surface of the body at any convenient point while the other is in contact with the needle. The needle, which is insulated down to the point, is introduced carefully in the direction of the nerve while an assistant slowly turns the dynamo. The instant the point of the needle comes in contact with the nerve it is manifested by a muscular contraction in the usual way. The electrode is then removed from the needle and the fluid injected directly on the nerve. Time will not permit a detailed description of the points of election for reaching the various accessible nerve trunks, but a few words may be said in regard to blocking the sacral plexus by intrasacral injection. Sacra vary greatly in their form,

degree of curvature, and completeness of development, particularly of the lower part of the posterior surface. This, as a rule, is incomplete, leaving the sacral canal open at this point. This opening may vary from almost nothing to 3 or 4 cm. in length, and usually extends up higher in men than in women. The point to enter this canal is at the end of this open space, and the best guide to this point is the last spinous process of the sacrum. A small depression can be felt, as a rule, just below this spine, and it is at this point that the needle should be introduced in the direction of the sacral canal. The open space of the sacrum is bridged over with dense ligamentous tissue, and it requires considerable force to push the needle through it; and when the needle passes through, it may be felt to enter a rather free space. The needle cannot be pushed up into the sacral canal more than a few centimeters before it strikes the bone of the posterior wall. The extent to which it will enter depends upon the degree of curvature of the sacrum. The ordinary needle should not be used for this purpose because of the danger of breaking it off in the sacral canal, an accident that has happened twice to me, once necessitating chiseling away a portion of the posterior wall of the sacrum in order to remove the broken piece. I have had made for this purpose a small trocar, the stylet being made of hard steel and the cannula of softer metal, so that it will not break. The cannula, of course, is made to fit the syringe. There is one point in connection with the method of injecting which I think of great importance, and that is that the needle should always be introduced detached from the syringe, and one should wait long enough before injecting to be sure that no blood (or spinal fluid in the case of the sacrum) escapes from the needle, otherwise the fluid may be injected directly into the circulation, with possible serious or fatal result.

The physiochemistry of the subject is largely an unwritten chapter. That certain substances in solution, when brought in contact with nerve cells, whether in nerve centers or trunks, will suspend temporarily cell activity, is well known, but the phenomena await a satisfactory explanation. Experiment shows

that the action of these substances is not limited to nerve cells, but in fact affects all living cells, in the same manner though in varying degree. However, all of these substances have a marked elective affinity for nerve cells. It is perfectly evident that any substance which has the power of suspending nerve-cell activity must be highly toxic, and will cause death if brought in contact with vital nerve centers in sufficient strength. All known substances, therefore, which produce local anesthesia are very markedly toxic, the toxicity varying, other things being equal, in direct ratio to their anesthetizing properties. Taking novocain as the substance of this class with which we are most familiar, we find that its effect on the nerve is a transitory one, persisting only so long as the drug itself is present. It enters into no permanent combination with the nerve cells, and just as soon as it has been removed the nerve returns to its normal function. Inhibiting effect is proportional to the amount of novocain present up to the point of complete blocking, and beyond that there is no other effect apparent. Anything which will delay the absorption of the novocain will prolong the anesthesia. As is well known, epinephrin added to the solution materially intensifies and prolongs the anesthesia by reason of its contractile effect on the bloodvessels. The local ischemia which results simply delays the absorption of the drug, thus allowing it to remain a longer time in contact with the nerves. There are other substances which, when added to the novocain solution, intensify and prolong the effect by delaying absorption. The substance which I have found most useful in this respect is calcium chloride. This may be added to the solution in a proportion of 0.5 to 0.8 per cent.; the more calcium added the longer the anesthesia lasts. All these substances cause death by cardiorespiratory paralysis. Novocain is no exception to this rule, and whenever it or any of these substances is present in the blood in sufficient amount to suspend the action of the nerve cell of these centers, death must result. As novocain is eliminated from the blood quite rapidly, quite large quantities may be introduced locally, provided absorption is delayed sufficiently to prevent its concentration in the

blood exceeding a certain degree. On the other hand a very small amount, if injected into the blood current quickly, so that it reaches the nerve centers in the concentrated form, may produce almost instant death. This is the reason for insisting that the needle be introduced detached from the syringe and the injection not made until it is certain that the point is not in a bloodvessel. This is not simply theoretical, as I have killed animals quickly in this way, and I have knowledge of a case in which death occurred very suddenly following injection in disregard of this injunction. In this case the needle attached to the syringe was introduced into the tonsil and peritonsillar tissues and a solution of novocain injected. Following one of the injections the patient suddenly collapsed and died, with symptoms of cardiorespiratory paralysis. From the above it is perfectly evident that there is no definite toxic dose of novocain, as its effects depend largely upon the manner of its introduction. When it is injected into the tissues extravascularly its general or toxic effects depend entirely on the rapidity of its absorption, and if its absorption be delayed by the means mentioned relatively large quantities may be used almost with impunity. It has been found, too, that certain regions of the body absorb more rapidly than others; for instance, the peritoneum, the gums, the tonsils and peritonsillar region, and the perivertebral region; hence, injections in these regions should be made with special care. Likewise care should be used in injecting the sacral canal not to have the point of the needle in the lower end of the spinal sac nor to inject too rapidly, as syncopy may be induced.

Under physiology of local anesthesia may be considered the local and general effects. When a solution of novocain is injected into the skin, so as to come in contact with the terminal-nerve filaments, anesthesia results almost immediately. If it be injected so as to block a nerve trunk in continuity anesthesia develops more slowly, depending upon the size of the nerve and the strength of the solution. As is well known, there is not only the usual sense of touch, but also a sense of pain, of temperature, of pressure, and the so-called muscle sense. When a nerve is

blocked all of these forms of sensation do not disappear at the same time. The first sense to disappear is the sense of pain. During this stage the patient may be able to feel when a surface is touched and may be able to recognize the kind of object with which it is touched, as, for instance, the point of a pin; but at the same time he will say that he feels no pain even though the pin be stuck clear through the skin. The temperature sense is then lost, next the tactile sense, and finally the pressure sense. The muscles are quite sensitive to ordinary trauma, although some are much more sensitive than others. For instance, the abdominal muscles, internal oblique, and transversalis are quite sensitive, while muscles of the extremities, such as the biceps, are less so. When a large nerve trunk, such as the anterior crural, is blocked just below Poupart's ligament the anesthesia progresses from above downward, the most distant point supplied by the nerve being the last to become anesthetic. This is due to the fact that the fibers nearest the surface of the nerve are the ones given off first, and as these are naturally the first to become affected, the anesthesia proceeds from the proximal to the distal part of the area supplied. In the case of mixed nerves, sensation is lost before motion; thus the arm may be anesthetized, yet the patient be able to move the hand and fingers at will; but if the solution used is strong enough, motion too soon becomes lost.

Occasionally rather peculiar phenomena are observed. For instance, while removing an unusually large bunch of glands from the neck recently I had occasion to divide the sternomastoid muscle at its upper end, preserving the spinal accessory nerve, which was surrounded by enlarged glands. On touching the nerve, contraction of the muscle occurred, and the patient complained of a severe pain deep in the head on the same side above the eye. The nerve was then blocked as near its exit from the base of the skull as possible. Touching the nerve now no longer produced contraction of the muscle, nor pain, but traction on the nerve with a blunt hook, in order to hold it out of the way, produced the same tense pain deep in the head, but no muscular contraction. It was rather difficult to explain the

referred pain in this case. It may be mentioned in this connection that it is not always an easy matter to determine just why one has pain in the head, or headache. I have operated on fractures of the skull and have done decompression operations under blocking, and, so far as my experience goes, the dura is not sensitive to ordinary trauma. Since I have been operating under nerve-blocking on conscious patients, many interesting observations have been made in connection with painful sensation, which are very illuminating and of great help in the explanation of many of the symptoms of which patients complain. We must recognize that pain may be due not only to trauma as ordinarily understood, but also to disturbed function. There are receptors which translate impulses due to disturbed function into terms of pain, yet are unaffected by ordinary trauma.

In other words, receptors and centers, as a result of evolution, have become, as it were, sensitized to certain stimulæ and are unaffected by others. For instance, the stomach may be cut or bruised without producing the slightest pain, but disturbed digestion may cause very severe pain. The appendix may be ligated and cut without the patient being conscious of any sensation, but if a hypodermic needle be introduced through the wall of the appendix into its lumen and the appendix distended with fluid back of an obstruction, such as a ligature placed about its base, severe pain is produced at once in the epigastric region, with nausea and vomiting, a reproduction of symptoms commonly seen in acute appendicitis. If the mesenteriolum of the appendix be blocked before making this experiment no epigastric pain nor nausea will result. As is well known, the parietal peritoneum is sensitive and responds with a sensation of pain when traumatized, but not all parts of it are equally sensitive, nor do all parts return the same painful sensation when irritated; for instance, if we irritate the peritoneum in the cul-de-sac of Douglas with a sponge, for example, the patient will complain of a sensation of weight or bearing down in the pelvis and of a fulness in the rectum, symptoms frequently complained of by many gynecological patients. Irritation of the peritoneum back of the

symphysis pubis and about the bladder causes a desire to urinate, which may be even painful. The anterior parietal peritoneum is quite painful when irritated and the pain can usually be quite accurately located by the patient. In addition to the pain, spasm or rigidity of the abdominal muscles occurs. This latter is so frequently present that when picking up and incising the peritoneum under blocking, if the abdominal wall is lax and no increased abdominal tension found, it is certain evidence that the peritoneum at that point is blocked.

The ligation or clamping of large bloodvessels causes a sensation of pain, even in regions otherwise quite well blocked. A good example of this is seen in the ligation of the superior thyroid vessels in the removal of goiter. This pain, however, is easily prevented by proper blocking.

We now come to the general effects of the local anesthetic, novocain, on the patient, and to the effect on the patient of operating under blocking. As already stated, novocain, like all similar substances, is toxic, and if given in sufficient amount will cause death. However, as the toxic effects depend upon the concentration of the solution which reaches the nerve centers rather than upon the total amount injected, relatively large amounts may be injected subcutaneously, provided the rate of absorption is retarded. In thousands of injections of the novocain, calcium, magnesium solution in all kinds of subjects, septic and non-septic, with kidney trouble, with heart disease, with high blood-pressure, with low pressure, and in all ages, from childhood to into the eighties, I have never yet seen anything which approached serious toxic symptoms. Formerly it was not uncommon for a patient to become pale and complain of feeling slightly weak shortly after an injection, but this always passed off in a few minutes, and I am convinced the symptoms were due to too much epinephrin, for since I have reduced considerably the amount of epinephrin added to the solution these symptoms have practically disappeared. Novocain, like all these substances when in sufficient concentration in the blood, causes a fall in blood-pressure; but in the amounts and in the solution which I

have used the effects on the blood-pressure have been very slight and practically negligible. The effect on the pulse is, as a rule, to slow it down. This is particularly noticeable if the pulse has been accelerated by fear of pain, or apprehension about the operation. Formerly I gave practically all patients one dose of morphin and scopolamin or morphin and atropin hypodermically, about three-quarters of an hour before the operation, with the idea that it quieted them and seemed to make them more or less indifferent to what was going on; but for some time now I have discontinued all hypodermics before the operation and am convinced that in the majority of cases patients do better and have less after-disturbance. That a hypodermic of morphin in an occasional case is desirable or even necessary is recognized, but that it is needful in a majority of cases to overcome the psychic effect of doing an operation on a conscious patient I am certain is not correct; in fact, I am convinced that the harmful, psychic effect has been greatly exaggerated. It is rare nowadays for a patient to come to the operating table with a fear that he is going to suffer pain during the operation, while the number that come asking to have the operation done under local anesthesia so they need not lose consciousness is constantly increasing as knowledge of the method becomes more general. Many times I have seen a facial expression of fear give way to a pleasant smile just as soon as the patient saw and realized that the flesh was being cut without the slightest sense of pain, and it is quite the rule for patients after the operation is over to volunteer the statement that they suffered no pain and that they would much prefer the local to that of general anesthesia.

If the region operated on is completely blocked so that no afferent impulses reach the brain or nerve centers, no shock results from the operation, except that due to loss of blood and the general handling of the patient. It is quite remarkable, at times, how the pulse will continue right along uninfluenced by the operation and scarcely changing a beat from beginning to end. Patients will sometimes become tired lying in one position, but there is usually no objection to allowing the patient to change

the position to a more comfortable one. If the operation is to be an unusually long one a hypodermic of morphin will enable the patient to lie still without becoming so tired. The after-effects are very much less severe than after a general anesthesia. Vomiting, when it occurs, is slight. An hour or two after getting back to bed the patient may have a little nausea and perhaps vomit slightly once or twice. The vomiting is never severe nor protracted, and many patients will ask for and be able to take light nourishment on reaching their room. When the effects of the anesthesia wear off there will be a slight burning sensation in the wound, the same as there is in a wound made under any other conditions. This sensation seldom amounts to a pain severe enough to require the administration of an anodyne.

The field of application of local anesthesia is constantly enlarging with increased experience, and its use is becoming more widespread, which is good evidence not only that it is efficacious, but that it has real advantages over general anesthesia. Concerning its field of usefulness, I may say that there are few operations in which it cannot be used to advantage even when a general anesthetic is necessary for a part or all of the time. In a great majority of the operations nerve-blocking alone is amply sufficient and very satisfactory. Included in this large group may be mentioned practically all hernias, whether inguinal, femoral, umbilical, or ventral; appendectomies, acute and chronic; many cases of cholelithiasis, when the stones are limited to the gall-bladder; many gastro-enterostomies and other operations on the stomach; exploratory laparotomies; almost all operations on the bladder, prostate, perineum, scrotum, vagina, lower rectum, cervix, uterus, these latter being done under sacral blocking, which is eminently satisfactory. Operations on the extremities, including amputations, amputation of the breast, resection of ribs, goiters, tubercular glands of the neck, laryngectomy, and many other operations on the head and neck. It will thus be seen that the list of operations suitable to nerve-blocking is quite large. Time, however, will not permit a more extended reference to the method of blocking in particular cases.

We come finally to the advantages of blocking over general anesthesia. That all general anesthetics have connected with them a certain element of risk I think will be admitted without argument. In fact, the general anesthetic furnishes by far the major part of the risk connected with minor operations, in such operations as uncomplicated appendectomies, herniotomies, etc., and this risk is practically eliminated by blocking. I have seen but one case of pneumonia following an operation under blocking; that was in a case of toxic goiter. The patient on the second day postoperative had a severe chill followed by a typical croupous pneumonia, from which she died in a few days. This is in marked contrast to the number of pulmonary complications following ether anesthesia. I have seen no postoperative kidney or liver complications. That there is infinitely less discomfort after local than after ether or chloroform anesthesia I think no one who has witnessed these cases will attempt to deny. The ether sickness which is so distressing, and even more dreaded by many patients than the operation itself, is never seen after blocking. Formerly, when I used morphin before the operation, the percentage of postoperative vomiting was quite high, being a little over 20 per cent.; but the vomiting was never severe, amounting to only a slight nausea, with one or two vomiting spells coming on from one to three hours after the operation. Since I have discontinued the morphin the after-disturbance has been very much less, and slight vomiting has occurred in only 4 per cent. of the cases, showing conclusively that the greater part of the postoperative disturbance experienced in my earlier work was due to the after-effects of the morphin.

AN ANATOMICAL AND EXPERIMENTAL STUDY OF SACRAL ANESTHESIA

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Sacral anesthesia has become so firmly established in the surgical clinic of the John Sealy Hospital as one of the safest and most valuable means of producing local anesthesia in the regions supplied by the sacral nerves that it has passed completely beyond the experimental stage. It is used as a routine procedure in all operations on the anal canal and lower rectum, in perineal operations, in external urethrotomies, and in operations on the body of the penis. Also, when combined with local infiltration of the abdominal walls in cystotomies and suprapubic prostatectomies. We have been following pretty closely the method advised by Harris, of Chicago, and it is our custom to inject 30 c.c. of the solution into the sacral canal and give it sufficient time to diffuse along the space outside the dura mater where it bathes the peripheral nerves before they pass out through the intervertebral foramina. The quantity injected is 30 c.c., and the solution is made by dissolving three No. A tablets in 30 c.c. of distilled water and adding 10 drops of a 50 per cent. solution of calcium chloride. (The composition of the A tablets is novocain, 0.125 gm.; suprarenin, 0.000125 gm.) As a rule one injection is sufficient, and at the expiration of half an hour anesthesia is complete in the branches supplied by the sacral nerves. We have injected a second time not infrequently and have never failed after a second injection to secure perfect anesthesia. The quantity of novocain used has been consid-

erable, as much as 0.75 gm. having been introduced into the peridural space in the two injections. So far as our experience goes we have never seen evidence of toxic symptoms.

The period of onset, the area of distribution, and the intensity of the anesthesia show considerable variation. We have found that the region of the anus seems to lose its sensibility first, and that operations involving cutting and burning can be performed within ten to fifteen minutes after the injection has been made. The patient will often resent rough dilatation of the sphincter, even though anesthesia may be complete to the knife or cautery. We have not been able to establish any definite sequence in the order in which the sacral nerves are affected; although we believe that the effect is more rapid the nearer the nerve trunk lies to the bulk of the fluid injected. We have found that the greatest intensity of action is shown in the areas supplied by the sacral nerves from the second downward, but that it extends in many cases upward beyond the second sacral as high as the upper lumbar and lower dorsal nerves. In one case the injection was made at 10.17 A.M., and at 11.16 A.M. anesthesia was complete below the level of the umbilicus, and was associated with loss of sensation and motion in both legs (see Fig. 3, Case B). The regions supplied by the first lumbar and twelfth dorsal nerves are anesthetized in a large proportion of cases, and sometimes the anesthesia is deep enough to allow us to perform operations on the scrotum, inguinal region, dorsum of the penis, and the suprapubic region of the abdomen. We have, however, found that in women the clitoris and labia minora do not often lose their sensibility completely. In some cases of cancer of the cervix uteri the introduction of a large vaginal speculum has been painful, whereas extensive cauterization of the cervix and upper vaginal wall has been absolutely painless.

The appended charts, which were designed for our use by my colleague, Professor William Keiller, have been of great service in enabling us to show in a graphic manner the area of anesthesia, the time taken for the anesthetic to produce its effect, and

the spinal segments affected. Two of these charts, one of a male and the other of a female, are exhibited as types. On reflection

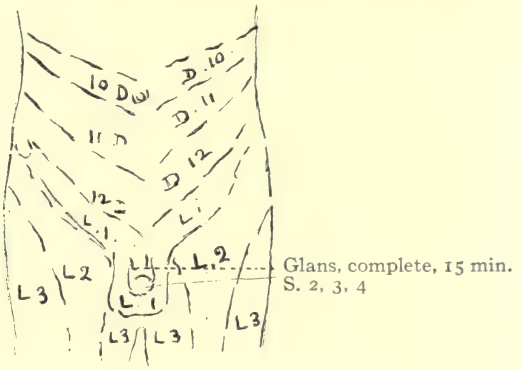


FIG. 1.—Male. Anterior view. Stricture of the urethra.

it seemed probable that the anesthetic effect was produced by the absorption of the drug into the peripheral nerves outside the dura mater and that the intensity of the effect would be

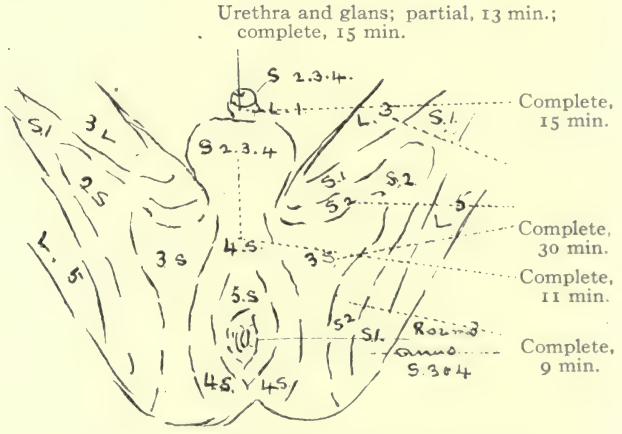


FIG. 2.—Male. Perineal view. Stricture of urethra.

greatest in the nerves closest to the site of injection. This is evidently borne out by experience. The injecting needle seldom

passes higher than the third sacral vertebra, and the bulk of the fluid is injected at this level, producing its maximum effect in

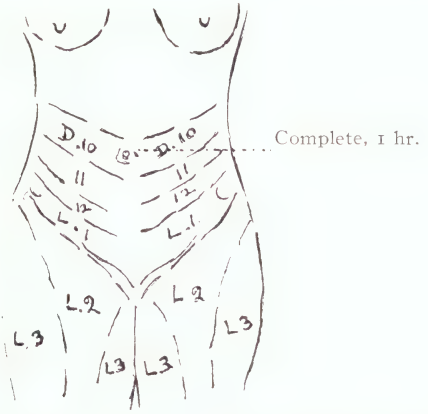


FIG. 3.—Female. Anterior view. Case B. Loss of sensation and motion in both legs. Complete loss of sensation as high as the umbilicus.

the sacral nerves. A fair quantity of the fluid probably flows much higher and produces an anesthetic effect on the upper

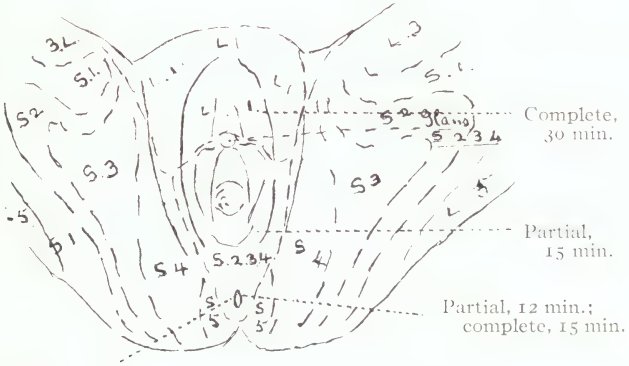


FIG. 4.—Female. Perineal view. Stricture of rectum. Case A.

sacral and lumbar nerves, and even on the thoracic nerves. This is of much less intensity, and in the majority of cases is

rarely complete. In a few rare instances, however, we find sensation and motion lost in both legs and anesthesia complete as high as the lower thoracic nerves.

The fluid evidently becomes diffused to a very high level, and we have been able to demonstrate this effectually on the cadaver. During the last winter, by the courtesy of Dr. William Keiller, I was allowed to follow the experiments upon cadavers used by the junior class in surgical anatomy. Fifteen bodies were used, and in each case 30 c.c. of aqueous solution of eosin was injected into the sacral canal. A needle 6 cm. long was used in each case. The dissection of the sacrum and spinal canal was made immediately, and as soon as the data in this region were obtained the spinal canal and cord were exposed in the thoracic region opposite the spine of the scapula (third thoracic vertebra). Roughly speaking, in every case, in half an hour, the sacral and lumbar regions of the cord were exposed, and at the end of an hour the dorsal region was laid bare.

The appended table shows the anatomical findings:

Number of dissecting room table.	Level of lower end of dura mater.	Upper level reached by the staining fluid.
3	Third sacral vertebra	Third thoracic vertebra.
26	Second sacral vertebra	Third thoracic vertebra.
7	Junction of second and third sacral	Seventh cervical vertebra.
9	Junction of second and third sacral	Sixth thoracic vertebra.
11	Second sacral	Third thoracic vertebra.
5	Third sacral (lower border)	Sixth thoracic vertebra.
15	Second sacral (lower border)	First sacral vertebra.
17	Junction of second and third sacral	Seventh cervical vertebra.
23	Second sacral (lower border)	Third thoracic vertebra.
19	Second sacral	Third thoracic vertebra.
20	?	Tenth thoracic vertebra.
13	Second sacral	Third thoracic vertebra.
1	Third sacral (upper border)	Third thoracic vertebra.
28	Junction of second and third sacral	Third thoracic vertebra.
Demonstration body	Third sacral.	?

The following points may be emphasized:

1. In only one subject (cadaver No. 19) was there a failure to inject. This was caused by a curved sacrum and an unusually narrow and flattened canal. The peridural space was eventually injected through a puncture in the lower lumbosacral region, and the data are given as if the sacral canal had been injected from below.

2. In every case, as a matter of routine, the dura mater was exposed above the third thoracic vertebra (the level of the spine of the scapula). Most of the students did not have time to expose the dura in the cervical region of the cord, but there is every probability that the staining went much higher than the third thoracic. In the two cases in which the dura was exposed at the level of the seventh cervical vertebra the outer surface of the dura was so deeply stained as to suggest staining at a much higher level.

3. In not a single body was any of the injection fluid found inside the dura mater. This means that the needle used slipped alongside the dura mater without puncturing it. This observation agrees absolutely with our clinical experience. We can only remember one clinical case in which the dura mater was penetrated by the needle. It appears from this that there is very little risk of intradural injection.

4. In the demonstration body it was noticed that while the injection was being made the eosin solution flowed out from both external iliac veins. This suggests that the needle had probably punctured a large vertebral vein and that the fluid was being forced directly into the systemic venous system. The possibility of repeating this in a living subject is suggestive.

5. In every case there was deep staining of both the anterior and posterior branches of the sacral nerves. The staining reached out far from the bone. As the sacral canal was exposed a few minutes after the injection the diffusion of the coloring matter along the nerve sheaths must have been a matter of a few minutes. It was interesting to notice that the diffusion of the coloring matter extended along all the nerve trunks. Thus

the twelfth dorsal nerve was found deeply stained in most of the bodies, and in the cases in which the coloring matter had passed up to the cervical region in any intensity the posterior branches of the cervical and upper dorsal nerves also showed deep staining.

6. It appears justifiable to conclude that the coloring matter injected passed along the peridural space without any difficulty and traveled upward outside the dura mater. In its passage it bathed the peripheral nerves, and some of it passed outward along the lymphatic channels of the nerve trunks.

In not one case did any of the coloring matter gain entrance to the subarachnoid space. The cord and the roots of the nerves were unstained. The path along the peripheral nerves was evidently wide open in the cadavers, because in no instance was any excess of staining fluid found outside the dura mater.

It is, of course, unwise to assume that the paths taken by the staining solution are identical in the cadaver and in the living subject, but our clinical observations have supported the view that the diffusion of solutions of novocain follow in the main the same paths taken by the stain in the dead-house observations. We have recorded a number of clinical cases in which sacral injections were accompanied by anesthesia in the ilio-hypogastric, ilio-inguinal and twelfth dorsal nerves.

By the courtesy of Dr. O. J. Potthast, demonstrator of anatomy in the University of Texas, I am able to insert data obtained from experiments performed on fifteen other cadavers dissected by the sophomore class. The following technic was employed. A needle 6.3 cm. long was used and 30 c.c. of an aqueous solution was injected into the sacral canal. The needle was thrust in as far as it would go and about one-third of the fluid injected. As the needle was gradually withdrawn the rest was injected. The sacral canal was opened immediately, but the spinal canal in the upper lumbar and dorsal region was not examined until ten days afterward. The following data were obtained:

In 2 of the bodies the injection had been made intradurally; in 11 the injection was extradural; in the remaining 2 the diffu-

sion of the stain made accurate observation impossible. In both cases in which the subarachnoid space had been injected the stain had passed upward to the base of the brain. In 1 of the cases, in which the injection was extradural, the stain had passed as high as the attachment of the dura mater to the margin of the foramen magnum. In 2 cases it had extended as high as the cervical segment of the spine. In 1 case, in which the stain had not passed higher than the lower end of the dural sheath opposite the second sacral vertebra, the stain had passed into the vertebral veins, which were found to be particularly large and dilated. In the other cases the stain extended on an average to the level of the ninth thoracic segments. The average distance of the lower end of the dura mater above the hiatus sacralis was about 5.6 cm. The shortest distance was 4 cm. (in this case the dura mater was punctured). The longest distance was 7 cm. The staining fluid entered the systemic veins in 2 cases. These observations were made immediately after the injection and not at the end of ten days.

A study of the sacral canal and of the hiatus sacralis was thought advisable in order to smooth out the mechanical difficulties of the operative technic. As a rule very little difficulty is met with clinically in passing the needle into the sacral canal. In a thin subject the bony margins of the hiatus sacralis can be felt distinctly. In fat people the bony landmarks are obscure, and a good plan is to introduce the needle about an inch higher up than the end of the sacrum, which can usually be felt plainly. In cases in which the coccyx is ankylosed with the sacrum an extra allowance must be made. The direction of the needle should be upward, exactly in the middle line, toward a point about 2 cm. deeper than the prominent spinous process of the first sacral vertebra. Some resistance will be felt as it penetrates the fibrous membrane, closing the hiatus. After this is punctured the needle passes along the canal with ease. It is not necessary to introduce the needle farther than 3 or 4 cm., although our experiments and clinical experience prove that the risk of wounding the dura is very slight. If, however, cerebro-

Number of museum specimen.	Distance in cm. that a probe can be passed upward along the sacral canal from the hiatus sacralis.	Upper level reached by the probe.	Type of sacrum.	Shape of the hiatus sacralis.	Level of upper end of hiatus sacralis.	Distance between upper end of hiatus sacralis and lower ends of the cornua.
1	4.5 cm.	2d sacral foramen	Very curved	Horseshoe shaped; short flattened	4th sacral foramen	1.5 cm.
2	6.0 cm.	1st sacral foramen	Slightly curved	Horseshoe shaped; very long	Between 3d and 4th sacral foramina	2.5 cm.
3	Whole canal	....	Flat	Long horseshoe	Lower part of 3d sacral foramen	3.5 cm.
4	5.0 cm.	2d sacral foramen	Quite curved	Short horseshoe; fused with coccyx	Lower part of 4th sacral foramen	1.0 cm.
5	Whole canal	....	Flat	Short horseshoe; fused with coccyx	Upper part of 4th sacral foramen	1.4 cm.; coccyx fused.
6	" "	....	"	Long horseshoe; broad	Lower part of 3d sacral foramen	3.0 cm.
7	" "	....	"	Short horseshoe	Lower part of 4th sacral foramen	1.9 cm.
8	" "	....	"	Broad horseshoe; fused with coccyx	Lower part of 4th sacral foramen	1.9 cm.
9	" "	....	"	Broad, short horseshoe	Lower part of 4th sacral foramen	1.0 cm.
10	6.0 cm.	Upper part of 2d sacral foramen	"	A shallow curve fused with coccyx	Upper part of 5th sacral foramen	Almost same level as apex; coccyx fused.
11	4.9 cm.	Between 1st and 2d sacral foramina	Slightly curved	Very long horseshoe	3d sacral foramen	2.7 cm.
12	Whole canal	....	" "	Very long and broad horseshoe	3d sacral foramen	3.5 cm.
13	5.8 cm.	Lower part of 1st sacral foramen	Curved	Horseshoe; very symmetrical	4th sacral foramen	1.7 cm.; cornua very prominent.
14	Whole canal	....	Flat	Sharply triangular	3d sacral foramen	2.6 cm.; cornua very prominent.
15	" "	....	"	Triangular; blunt at the apex	Between 3d and 4th sacral foramina	2.5 cm.; cornua very prominent.
16	2.5 cm.	Upper part of 4th sacral foramen	Very curved	Horseshoe	Between 4th and 5th sacral foramina	2.0 cm.; first coccygeal fused with sacrum.

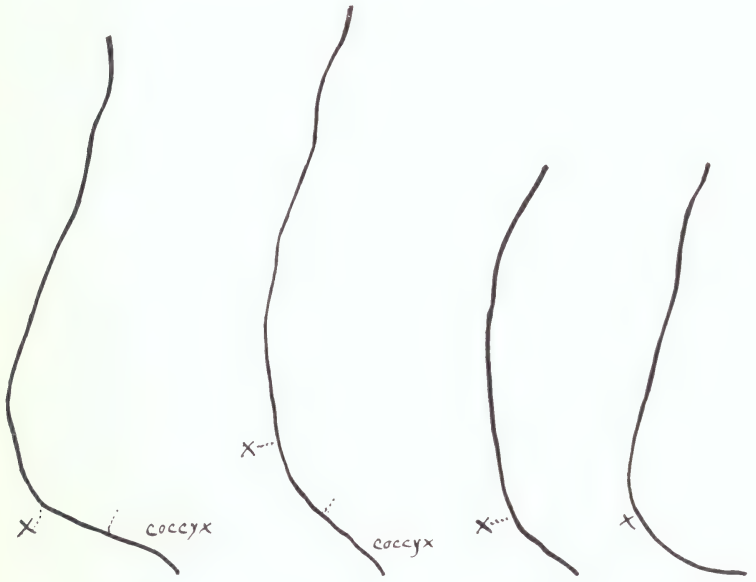
17	Whole canal	....	Flat	"	Lower end of 3d sacral foramen	3.5 cm.
18	" "	....	Very flat; curved at lower end	Equilateral triangle	Between 3d and 4th sacral foramina	2.3 cm.
19	" "	....	Flat	High isosceles triangle	Between 3d and 4th sacral foramina	3.0 cm.; cornua overhang 5th foramen.
20	" "	....	Quite curved	Long horseshoe	Lower part of 3d sacral foramen	5.0 cm.; whole coccyx fused.
21	" "	....	" "	An isosceles triangle	Between 3d and 4th sacral foramina	4.5 cm.; cornua fused with coccyx.
22	" "	....	Flat	Short horseshoe	Upper part of 4th sacral foramen	1.0 cm.; fused coccyx.
23	" "	....	Very curved	An isosceles triangle	Between 3d and 4th sacral foramina	3.3 cm.
24	" "	....	Flat	Very irregular	4th sacral foramen	1.0 cm.
25	5.5 cm.	Lower part of 1st sacral foramen	Curved	Horseshoe with contracted ends	Between 3d and 4th sacral foramina	2.0 cm.
26	Whole canal	....	Flat, curved sharply at lower end	An irregular horseshoe	Between 3d and 4th sacral foramina	2.5 cm.; anterior and posterior walls of canal almost in contact.
27	" "	....	Flat	Horseshoe	Lower part of 4th sacral foramen	2.5 cm.; fused coccyx.
28	5.8 cm.	Lower part of 1st sacral foramen	Fairly curved	Small horseshoe	4th sacral foramen (compare No. 22)	1.5 cm.
29	Whole canal	....	Very flat	Obtuse-angled triangle	Between 4th and 5th sacral foramina	2.0 cm.
30	" "	....	Fairly curved	Very long triangle	Between 2d and 3d sacral foramina	4.0 cm.
31	" "	....	Flat	Horseshoe shaped	4th sacral foramen	2.0 cm.
32	" "	....	Very flat	Staple shape	Between 4th and 5th sacral foramina	1.0 cm.; canal very capacious.
33	" "	....	Flat	Horseshoe shaped	Lower part of 5th sacral foramen	2.5 cm.; fused coccyx.

spinal fluid escapes, the needle should be withdrawn to a lower level until the fluid ceases to flow. Then the injection should be made. If the needle lies in the sacral canal there is practically no resistance to the flow of fluid from the syringe. If it lies superficial to the sacrum there is usually a considerable amount of resistance to the flow and one sees immediately a subcutaneous tumor form at the site of injection. The whole operation can be rendered practically painless by preliminary infiltration of the skin and subcutaneous tissue over the hiatus with a solution of 0.25 per cent. novocain.

For the purpose of making the study more complete we have made a careful examination of the available "sacra" in the dissecting room of the University of Texas. In all thirty-three specimens were examined. The bones had been macerated and cleaned thoroughly, so that no fibrous or membranous material had been left attached to the cornua of the hiatus sacralis. A strong, straight steel knitting needle was used as a probe so as to preclude any possibility of bending and to imitate as closely as possible the behavior of the needle used for making injections. The probe was passed through the hiatus upward along the sacral canal, and if arrested the locality was compared with that of the sacral foramina and so noted down in the table. The following table gives an analysis of the anatomical features noticed.

In 24 out of the 33 specimens examined the probe passed along the whole canal. In the remaining 9 it passed in all except 1 (No. 16) as high or higher than the second sacral foramen. In this specimen it passed along the canal for a distance of 2.5 cm. and reached as high as the upper part of the fourth sacral foramen. The sacrum was very curved, especially at its lower end, and the level of the apex of the hiatus was just below the bend of the curve, between the fourth and fifth sacral foramina. The first coccygeal vertebra was also fused. The specimen is figured in one of the photographs, and a tracing of the curve is also shown in one of the figures.

In only one case was the canal so narrow as to raise doubts whether a needle could be passed along it. In specimen No. 26 the anterior and posterior walls were so close together as to reduce the canal to a mere slit, which, however, admitted the knitting needle. In every case of the series the sacral canal



No. 16 No. 20 No. 9 No. 1

No. 16.—Curved type of sacrum; fused coccyx. Opening of hiatus shown by a cross.

No. 20.—Long, flattened type of sacrum; fused coccyx. Opening of hiatus shown by a cross.

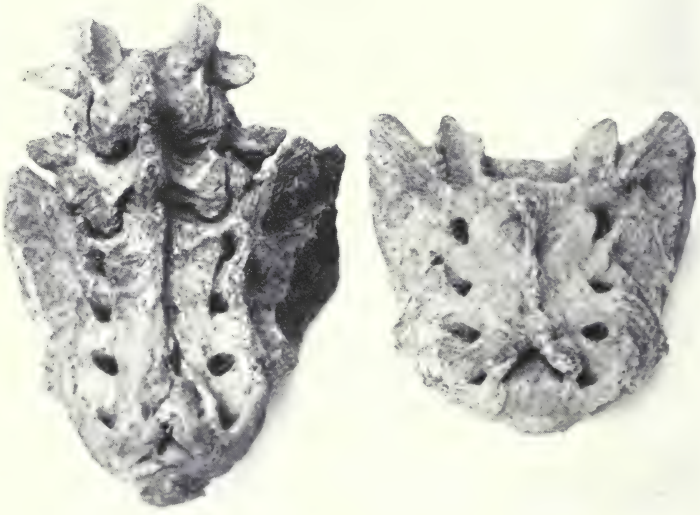
No. 9.—Short, flattened type of sacrum. Opening of hiatus shown by a cross.

No. 1.—Curved type of sacrum. Opening of hiatus shown by a cross.

was accessible to the needle. Even in No. 16, although the needle did not pass higher than the fourth sacral foramen, it entered the canal high enough to allow the needle to pass into the loose cellular space in which the sacral nerves lie. There seems no reason to doubt that if the needle penetrates the fibrous

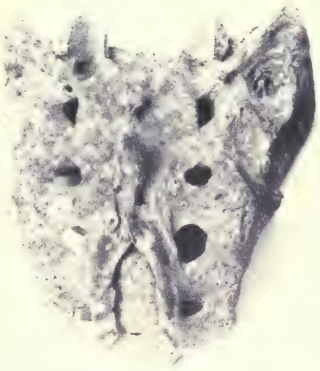
No. 5.—Sacrum moderately long. First coccygeal vertebra fused with sacrum. Hiatus fairly large, shaped like a horseshoe. Apex of hiatus bounded by an irregular mass of bone corresponding to the spinous processes of the 3d and 4th sacral vertebræ. Fifth foramen complete in front and behind on left side; complete in front only on the right side.

No. 15.—Hiatus large, triangular in shape, blunt at the apex. Margins of hiatus irregular and knobby. Formed by ununited spines of the 4th and 5th sacral vertebræ.



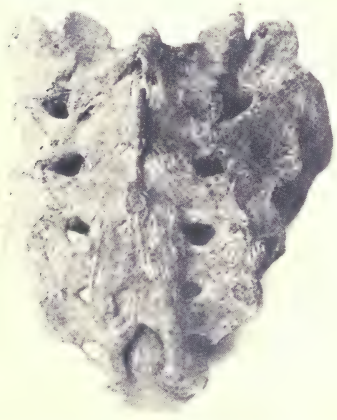
No. 29. — Sacrum rather long. Opening of hiatus shaped like a small obtuse-angled triangle. Margin of hiatus surrounded by massive knobs of bone. Apex of hiatus formed by united spinous processes of 4th sacral.

No. 18. — Sacrum very short. Margins of hiatus very prominent. Opening of hiatus shaped like an equilateral triangle. The 4th sacral spines have not united.



No. 12.—Hiatus very long and shaped like a horseshoe. The upper end is at the level of the 3d sacral foramen. The margins of the hiatus are formed by two flattened ridges in which can be seen rudiments of the spinous processes of the 4th and 5th sacral vertebræ.

No. 30.—Hiatus very long and shaped like an isosceles triangle. The upper end reaches to the upper margin of the 3rd sacral foramen. The margins are flattened and are formed by the unfused spinous processes of the 4th and 5th sacral vertebræ.

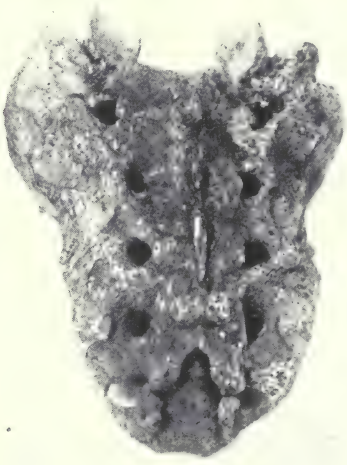


No. 16.—Showing first coccygeal vertebra fused with sacrum. Upper end of hiatus low down between the 4th and 5th sacral foramina. Hiatus well formed. Margins of hiatus formed by the fused spinous processes of the 5th sacral and 1st coccygeal vertebræ. The 5th foramen complete posteriorly and anteriorly.

No. 10.—Fusion of first coccygeal vertebra with sacrum. The 5th foramen complete in front; represented by a fissure behind. Hiatus represented by a transverse slit at the level of the 5th sacral foramen.

membrane which closes the hiatus and enters this loose cellular space the injected fluid will pass upward around the nerves and around the dura mater.

The tracings on page 457 show the curved and flattened types of sacra. (The numbers refer to the table.) No. 1 is a tracing of the anterior surface of a markedly curved sacrum. The coccyx was not fused. The cross shows the position of the upper angle



No. 27.—Fusion of first coccygeal vertebra with the sacrum. The 5th foramen complete in front, represented by a fissure behind. Hiatus extends upward almost to the level of the 4th sacral foramen. Margins are formed by the unfused spines of the 5th sacral and the cornua of the coccygeal.

of the hiatus. A probe passed as high as the second sacral foramen. No. 16 is also a type of curved sacrum. In this specimen the opening into the hiatus (marked by a cross) was just below the curve and a probe could not be passed higher than the fourth sacral foramen. No. 9 shows a short, flattened type of sacrum. The opening of the hiatus is shown by a cross. The probe passed along the whole canal. No. 20 shows a long, flattened type with a fused coccyx. The opening of the hiatus

is shown by a cross. The needle could be passed along the whole canal.

The sacra showed such variety that it was almost bewildering to attempt to divide them into types. I have appended three plates which bring into contrast certain peculiar features that deserve consideration. Four sacra of different lengths (see page 457) are contrasted to show the different position and shape of the hiatus and its margins. The legends are attached. In Nos. 12 and 30 a type with a very large horseshoe hiatus is shown. The contrast between either of these specimens and that of No. 29 is striking. In Nos. 10, 16 and 27 the type with fused first coccygeal vertebra is shown. The contrast between the shape of the hiatus in No. 10 and that in Nos. 16 and 27 should be noticed.

A METHOD OF GASTRO-ENTEROSTOMY

By FRANCIS T. STEWART, M.D.
PHILADELPHIA

If there are signs of gastric retention the stomach is emptied by lavage shortly before the operation.

The posterior wall of the stomach is exposed, as in the ordinary operation of retrocolic gastro-enterostomy, by tearing through the mesocolon. A celluloid suture is passed through the posterior wall of the stomach at or near the greater curvature, and through the antimesenteric border of the jejunum several inches from the duodenojejunal juncture. Upward traction on this suture causes the stomach and the intestine to fall together. A second suture then unites the apposed viscera at a point two inches from the original suture, *i. e.*, two inches nearer the duodenojejunal juncture. The distance between the sutures may, of course, be less or greater according to the judgment of the surgeon. The first suture is drawn toward the patient's left shoulder, the second toward the patient's right hip, thus lifting the parts to be anastomosed from the abdomen and bringing them into taut alignment. These sutures may be confided to an assistant or kept tense by attaching to each a pair of heavy forceps. The line of contact between the stomach and the intestine is now made permanent by a continuous seroserous suture, extending from the lower guide suture to the upper guide suture, and tied at the latter point, the end, however, being left long for use during the final step in the anastomosis (Fig. 1).

After shielding the general peritoneal cavity from contamination by means of an encircling gauze pad the peritoneal coat

of the stomach is incised close to and parallel with the line of suture, thus exposing the bloodvessels, which, with a small bite

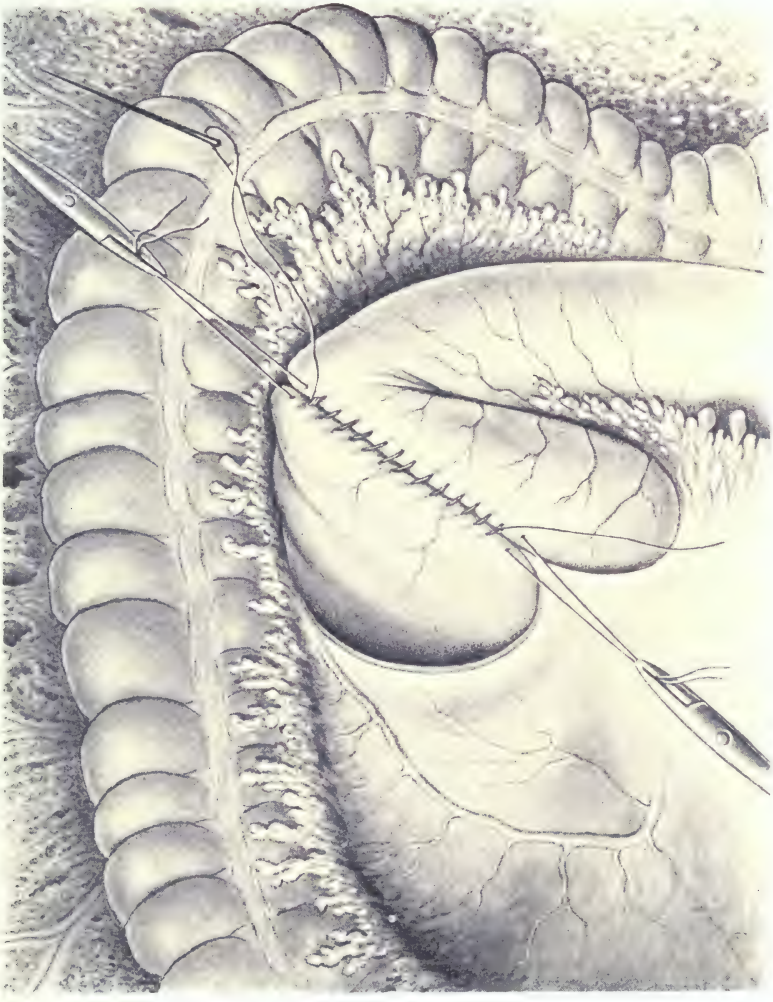


FIG. 1.—Gastro-enterostomy, showing the two guide sutures and the primary serosereous suture.

of the underlying mucous membrane, as yet unopened, are secured with hemostats at each edge of the incision (Fig. 2). The number of hemostats required varies with the length of

the incision and the vascularity of the part. The average is from five to six on each side of the incision. A smaller number

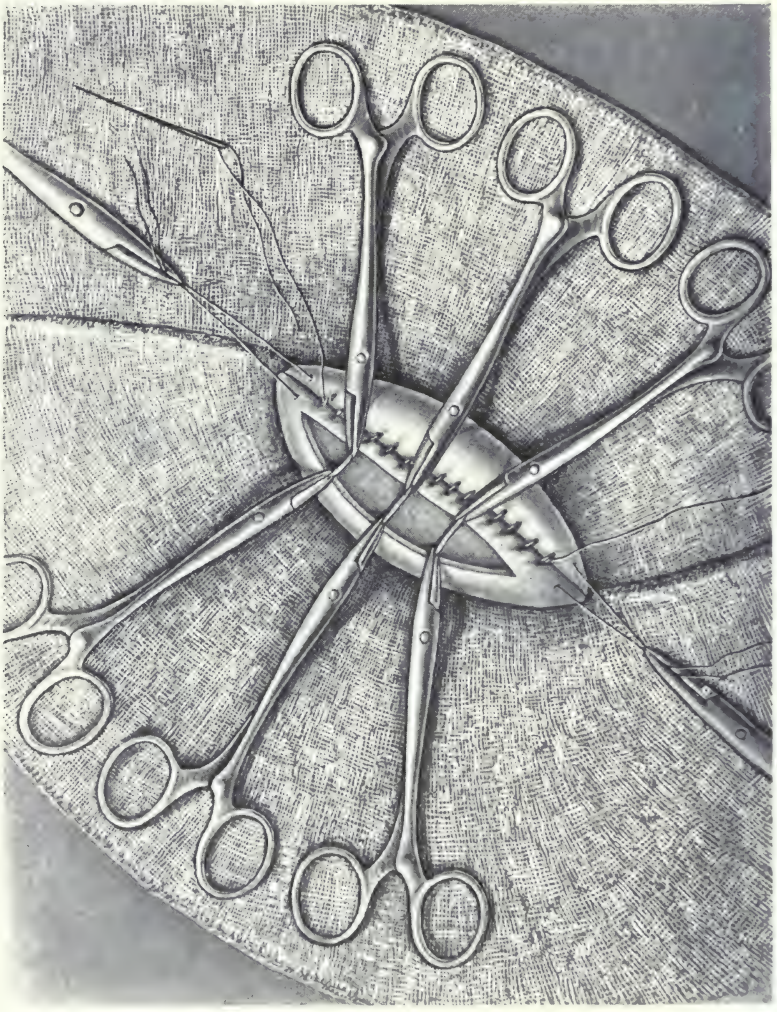


FIG. 2.—Gastro-enterostomy, showing forceps applied to the gastric vessels.

is shown in the illustration for the purpose of clarity. The mucosa is incised between the rows of forceps, thus opening the stomach. Additional hemostats may be needed to control

minute vessels which could not be seen before the incision into the stomach was made. A gauze pad is laid over the gastric

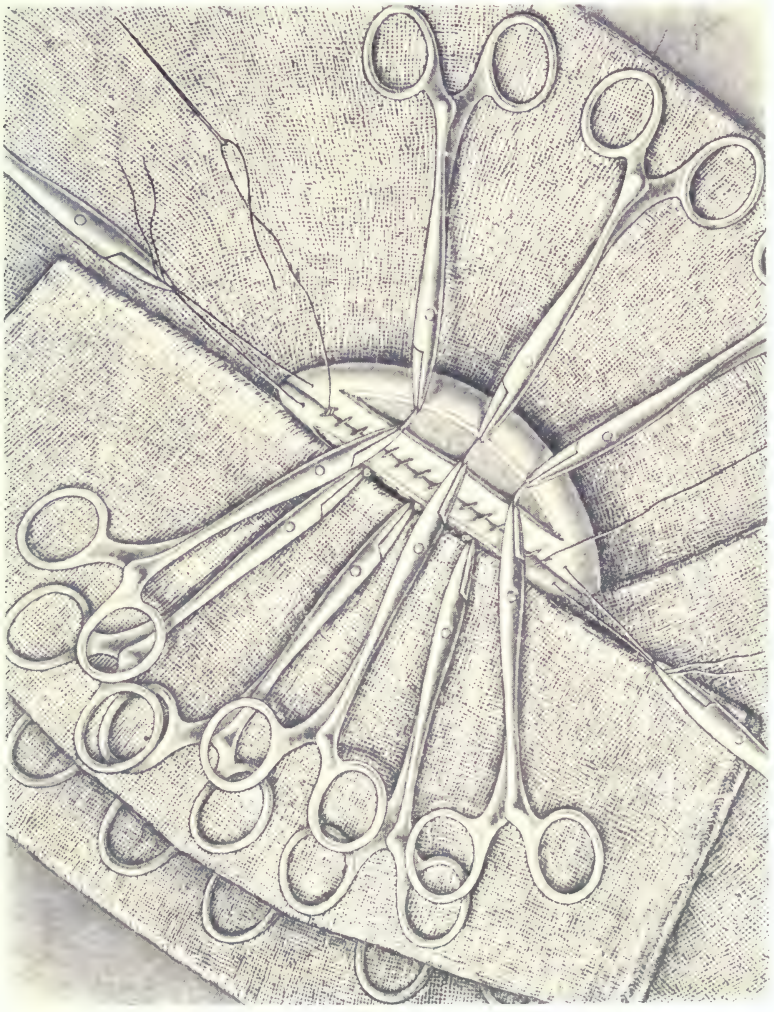


FIG. 3.—Gastro-enterostomy, showing forceps applied to the intestinal vessels.

incision, and the row of forceps nearer the intestine reflected onto the gauze. In the same way as in dealing with the stomach the outer coat of the intestine is incised, the vessels caught with

hemostats (Fig. 3), the mucosa opened, and the opening covered with a gauze pad. This leaves the posterior wound edges exposed.

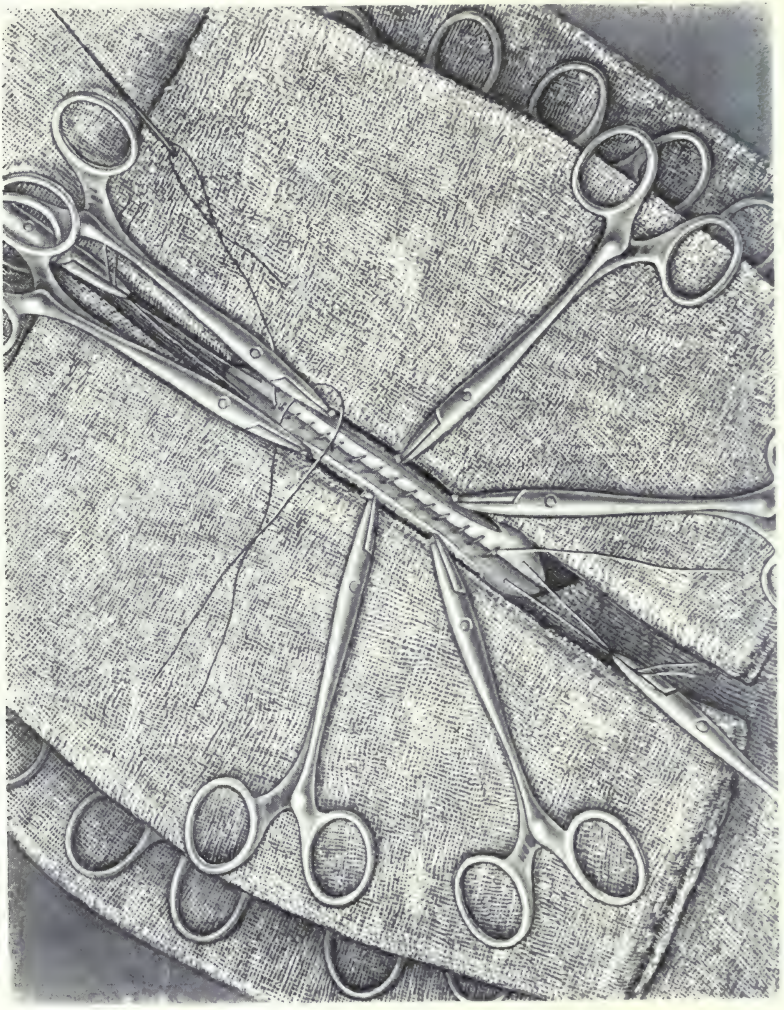


FIG. 4.—Gastro-enterostomy, showing the method of ligating the posterior vessels and wound edges.

Each pair of vessels (one gastric vessel, one intestinal vessel) in these exposed edges is ligated with a single strand of chromicized catgut, after drawing the edges together by means of the

two forceps (one on the stomach, one on the intestine) in closest proximity (Fig. 4). These ligatures not only prevent bleeding

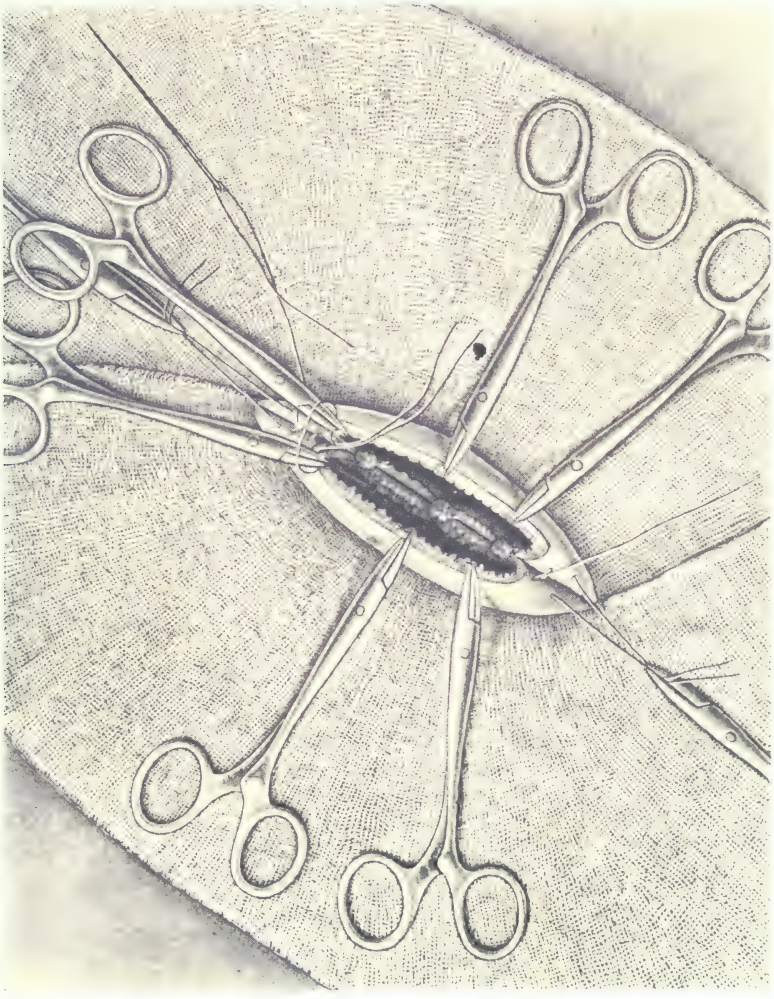


FIG. 5. Gastro-enterostomy, showing the method of ligating the anterior vessels and wound edges.

but also hold the edges in firm apposition. If a hemostat does not stand in close relationship with a fellow, an additional forceps may be employed to establish this relationship.

After removing the gauze pads which lay over the gastric and the intestinal openings the anterior edges of these openings

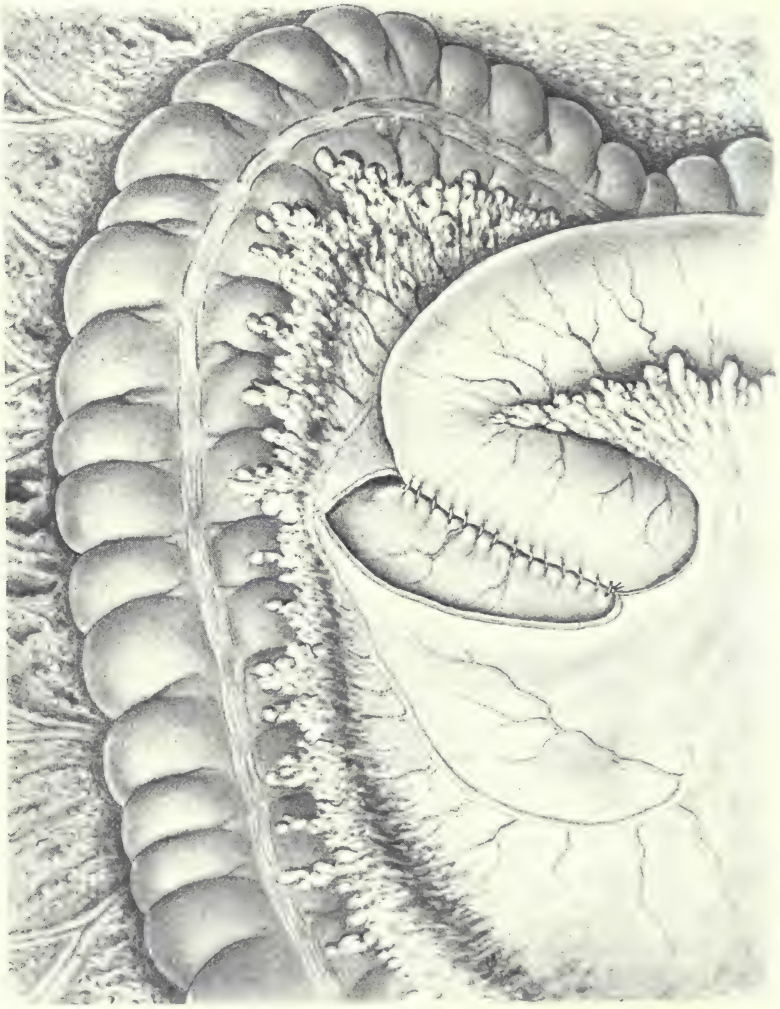


FIG. 6.—Gastro-enterostomy, operation completed by the anterior seroserous suture.

are drawn together by ligatures, beginning at the end farthest from the surgeon. The two forceps which lie opposite each other are held by an assistant. The right end of the ligature is passed

around the forceps on the intestine from right to left, the left end around the forceps on the stomach from left to right, thus the ends emerge between the forceps beneath the loop of the ligature (Fig. 5). The forceps are brought parallel to the long axis of the wound, rolled toward each other, thus inverting the mucous edges of the wound, the ligature tied, and the forceps removed. Each succeeding pair of vessels is dealt with in a similar manner. The result is the same as with the posterior wound edges, *i. e.*, hemostasis is assured, and the edges are bound firmly together.

The rest of the procedure is much like that usually followed. The seroserous suture is continued along the anterior portion of the anastomosis and tied at its point of origin (Fig. 6). The margins of the rent in the mesocolon are fastened to the stomach or the intestine.

The operation described above is easier to perform and less dangerous than gastro-enterostomy in which clamps are employed.

After the first guide suture has been inserted the structures to be joined are already in juxtaposition and there is no risk, even for the beginner, of confusing the relations of the parts, such as is possible during the application of clamps and their subsequent adjustment. Among the unreported disasters following gastro-enterostomy there are no doubt some which, thanks to inexperience and clamps, result from suturing the lower end of the intestinal opening to the upper end of the gastric opening. One of the stated advantages of clamps is that they steady and hold together the concerned viscera. As a matter of fact the stomach and the intestine are necessarily separated by the intervening blades of these instruments, whereas guide sutures not only permit direct apposition but at the same time create a ridge at the line of contact which facilitates suturing. The same degree of close alignment is obtained for the anterior seroserous suture, after the anterior wound edges have been inverted by ligatures. When clamps are employed the mucous membrane pouts, being squeezed out by pressure, and is usually excised. This excision is not needed in the operation without clamps. Suturing of the anterior edges of the mucous

membrane, even after the clamps have been rotated toward each other, is more difficult than the application of ligatures as described above. Further, one draws less stomach and less intestine from the abdomen when using guide sutures instead of clamps, or, to put it in other words, a longer anastomosis can be made, with the aid of guide sutures, than can be made with the same amount of stomach and intestine when clamps are employed, a consideration which occasionally is of some importance.

The danger of leakage of gastric or intestinal contents during the operation is no greater, perhaps even less, than when clamps are applied. Contusion or crushing of the tissues in the immediate vicinity of the anastomosis is avoided. Damage of this nature is potent for evil, especially in the old, the arteriosclerotic, the cachectic. The possibility of clamp injury predisposing to peptic ulcer of the jejunum, or causing necrosis at the site of anastomosis, although remote, is nevertheless real, and must be included in the evidence against the clamp. The greatest menace, however, is that of bleeding after the clamps have been removed. Like a tourniquet, the clamp increases the tendency to oozing of blood, after the removal of the compression, and when clamps are employed in gastro-enterostomy the hemorrhage, if all the severed vessels have not been closed, remains undiscovered until the patient vomits the blood or presents evidences of acute anemia. One is then confronted with the alternative of waiting hopefully, or of reopening the abdomen, during a critical period, in order to arrest the bleeding. Even carefully applied sutures are uncertain, so far as hemostasis is concerned, unless the wound is inspected after the clamps have been removed, since even large bloodvessels, unseen because empty, may readily be punctured by the needle. In the operation reported in this paper the surgeon ties all the open bloodvessels and may assure himself that hemostasis is complete. Of the 40 patients upon whom this operation was performed, 38 recovered without mishap. Two, both afflicted with inoperable carcinoma of the stomach, died of exhaustion and pneumonia, one on the sixth and one on the seventh day.

DISCUSSION

Dr. Howard Lilienthal, New York City:

Dr. Stewart's principle of operating without clamps is a good one. In all the gastro-enterostomy work which I have done I have never used a clamp. Formerly, I operated with the aid of holding sutures, as Dr. Stewart has shown here, but I did not use his forceps method. The operation which I have done for many years is so simple that it appeals to one's surgical sense. I use a stout piece of rubber dam, in the center of which is punched a perfectly round opening. Having put in the guide sutures, one at each end of the future stoma, and having left the ends long with needles attached, these sutures are drawn through the hole in the rubber dam. This hole is then distended digitally by the operator and an assistant draws the entire visceral field of operation through the opening, which is then permitted to contract by its elasticity, and we have the parts to be operated upon absolutely isolated. A sufficient part of stomach and jejunum is drawn into view to permit of easy operating without distortion. Spilling is very slight, and whatever visceral content appears merely soils the rubber dam. When the suture is finished except the last row the rubber dam is again distended and the field of operation slipped back. The last row is then put in. If a sufficient amount of the viscera has been drawn through the opening in the dam there will be no change in relations when the dam has been removed. Such change of relations does occur when forceps are removed, with consequent slipping away of vessel mouths and danger of hemorrhage. The idea was originally borrowed from Fenton B. Turck who, however, in using it for intestinal work made two openings in the rubber dam and was obliged to cut it away after his operation was finished.

ACUTE SUPPURATIVE CELLULITIS OF THE STOMACH: WITH REPORT OF THREE CASES

By EMMET RIXFORD, M.D.
SAN FRANCISCO

Acute suppurative cellulitis of the stomach, otherwise known as phlegmonous gastritis or gastric phlegmon, has long been known to pathologists, and occasionally has been met with by surgeons in exploratory abdominal operations. It is commonly reckoned as one of the rare affections of the stomach, for scarcely more than 150 cases in all have been reported. The increasing frequency, however, of publications of reports of cases during the last three or four years would seem to indicate that it is not so rare as commonly supposed.

In default of diagnosis before operation or autopsy, the few cases which possibly recover are lost, as are the many in which the cause of death has not been verified by autopsy. Doubtless, too, in many cases of carcinoma and chronic ulcer of the stomach infective cellulitis is the immediate cause of death, but, being in the relation of a secondary affection, if recognized, it is apt to be looked upon as merely a complication and hence receive little attention, or it is put aside as a terminal stage of an otherwise fatal malady.

In view of the almost invariably fatal outcome,[1] it is clearly

[1] Only one case cited by Emge, in which a diagnosis was made is said to have recovered spontaneously, and one, the case of Fritz Koenig (Deutsch. med. Wchnschr., 1911), recovered following a prompt gastrectomy. The case of Bovée (Am. Jour. Med. Sc., May, 1908), which was rather one of localized abscess of the stomach wall than of a diffuse phlegmon, recovered after evacuation of the abscess and drainage through an abdominal incision in spite of the fact that the patient was six months pregnant at the time and aborted soon after operation. Of this case, however, no bacteriological examination appears to have been made.

the duty of everyone who has observed such a case to record it in order that the actual frequency of the affection, its nature, cause, manner of development and clinical aspects may be better and more widely known, to the end that diagnosis may be made early, at least before operation or autopsy, and if the proper treatment be finally determined to be surgical, that the surgical indications and procedure shall be clearly defined. At the present time gastric phlegmon is still little else than a pathological curiosity, though it is an affection of which a good many people die.

A very considerable literature on the subject has been built up and it has been a favorite subject for graduation theses of German medical students in whose "inaugural dissertations" may be found excellent bibliographies as well as reports of cases from the German clinics.[1]

The earliest cases reported (Borel, 1656, Sand, 1695, Lieutaud, 1767, cited by Schnarrwyler) were cases of localized abscesses of the stomach wall. Brinton (*Lectures on Diseases of the Stomach and Intestines*, 1859) gave an excellent description of the disease under the title "Suppuration of the Areolar Tissue of the Stomach," and suggested the name "suppurative linitis," thereby distinguishing this affection from "cirrhosis of the stomach," for which he suggested the name "linitis plastica," which we now call Brinton's disease, or "leather-bottle stomach." Brinton described the affection as beginning with pain, burning sensations, thirst, persistent vomiting followed by febrile excitement which rapidly merges into prostration which is associated with delirium and ends in death by coma in from forty-eight hours to a few days from the commencement of the attack.

He called attention to the occurrence in some cases of a "chain of small abscesses more or fewer of which have burst through correspondingly small and distant orifices in the mucous membrane" and stated that "in its circumscribed form it may inaug-

[1] See the dissertations of Klaus (Erlangen, 1857), Löwenstein (Kiel, 1874), Reinking (Kiel, 1890), Jakoby (Koenigsberg, 1900), Schnarrwyler (Basel, 1906).

urate an ordinary ulcer," but that such a commencement of gastric ulcer is very rare, and he also remarked that the disease is related to pyemia. But since Brinton's knowledge of the pathology of the affection was gathered from postmortem examinations he speaks of the "rottenness" of the tissues of the stomach wall as being rather characteristic. He cites Dittrich (*Schmidt's Jahrbuch*, 1851, B. 72, p. 303), who made the observation, interesting in view of the subsequent determination of streptococci as the bacterial cause of the affection, that during an epidemic of puerperal fever in Prag many cases of suppurative inflammation of the submucous tissue of the stomach occurred, the stomach wall being sometimes more than an inch thick. Dittrich also called attention to the frequent occurrence of erysipelas in relation with such cases.

Thus the relation of gastric phlegmon to those diseases which we now know as streptococcic was clearly made out long before bacteria were known.

Löwenstein (*Inaug. Dis.*, Kiel, 1874) collected 23 cases of gastric phlegmon and gave credit to Heller in Kiel of having found cocci in such a case in that same year. In 1885 Sebillon found streptococci in a case of gastric phlegmon. Since then many cases have been studied and in practically all of them streptococci have been found, most frequently in pure culture and where in mixed culture most commonly associated with staphylococci.

Doubtless the nature of the organism of infection, together with the relative inaccessibility of the site of infection, the rapidity of its course, the difficulty of diagnosis, and the serious operative risk on account of the early depression of the patient, and the practical impossibility of avoiding dissemination of the infection in the peritoneum amply account for the high mortality.

It is also not unlikely that the peristaltic action of the stomach muscle and the churning action of respiration as well as the act of vomiting may favor spread of the infection through the loose cellular tissue between muscle and mucosa.

Clinically, gastric phlegmon is characterized by a sudden onset beginning with pain in the epigastrium, chill, burning sensation

in the stomach not relieved by drinking fluids, early and persistent vomiting, fever which may be slight and rise gradually but which has been known rapidly to reach 105° or 106°, early prostration, tenderness most often to the left of the median line, leukocytosis, 10,000 to 20,000, with high percentage of polynuclears, sometimes palpable gastric thickening making a diffuse tumor movable on respiration, often with congestion at the base of either or both lungs. This early stage is soon followed by hiccough, increasing prostration, muscular rigidity at first in the epigastrium, running pulse, cyanosis, cold extremities, sometimes diarrhea followed by constipation and abdominal distention: evidences of profound sepsis and advancing peritonitis. If the patient live long enough portions of the gastric mucous membrane may slough and come away in the vomitus. Death ensues in from three to ten days.

The diagnosis is difficult, for the earlier symptoms are common to several affections.

Basal pneumonia is difficult to exclude except by waiting, and this is fatal in gastric phlegmon. However, basal pneumonia is apt to be unilateral, marked by relative increase in rate of respiration, less marked epigastric tenderness and absence of palpable tender tumor.

Hemorrhagic pancreatitis is quite as fulminating in its onset as gastric phlegmon but commonly has a higher leukocytosis with less fever, often no fever at all.

Perforation of gastric ulcer is marked by a more sudden, even explosive, pain followed almost at once by muscular rigidity over a rapidly increasing area.

Acute gangrene of the gall-bladder has right-sided symptoms, perhaps the history of attacks of cholecystitis or biliary colic and often the distended gall-bladder can be felt.

If the matter of diagnosis be viewed from the stand-point of establishing indications for surgical intervention the problem is much simplified for the surgical world is agreed that early operation offers much the best chance for the patient suffering from gangrene or perforation of the gall-bladder, perforation of a

gastric or a duodenal ulcer, acute hemorrhagic pancreatitis, etc. Only in pneumonia is abdominal section likely to do positive harm and here an opening made under local anesthesia is not very dangerous and may be the only possible means of making a diagnosis by exclusion at a sufficiently early period. The other conditions are of course evident as soon as the abdomen is opened.

The cases are ordinarily divided into two groups, one in which the portal of entry of the infecting organism into the stomach wall is apparent, the other in which it is not.

Fink (*Boston Med. and Surg. Jour.*, November 30, 1916) suggested the following elaboration of this classification:

1. Primary or "idiopathic" forms in which the cause is not demonstrable.

2. Secondary forms. These further divided into

(*a*) Direct extension phlegmons, *e. g.*, from esophagitis.

(*b*) Local secondary phlegmons, *e. g.*, those which follow carcinoma or an operation (also ulcer?).

(*c*) Metastatic secondary phlegmons in which infection of the stomach follows the infection of some other part of the body.

The frequency with which the so-called idiopathic or fulminating forms follow streptococcic sore throat would seem to make distinction between the primary form and the metastatic secondary difficulty to be determined in particular cases. Repeated blood cultures in a large number of cases would be of interest, but it is questionable whether they would be of determining value because negative findings would be worth little and in the event of positive findings one could not say that the blood streptococci did not come from the stomach lesion unless blood culture should prove to be negative in a large number of cases of primary gastric phlegmon.

The prognosis would seem to depend on the relative attenuation of the culture: the greater the attenuation, the greater the probability of localization in a definite abscess of the stomach wall.

Since erysipelas and other streptococcic infections the propagation of the bacteria through the tissues is greatly impeded by scar tissue and even in the fulminating forms of gastric phlegmon, as said above, the infection does not pass the pyloric ring, one would expect the stroma of a carcinoma or the scar tissue of a chronic ulcer to offer an effective barrier against rapid diffusion of the inflammation. This would seem to be the case clinically, for there are many observations recorded of cases with multiple minute abscesses in the walls of a chronic ulcer whether simple or malignant and also in cases of chronic cellulitis of the stomach as mentioned by Brinton (linitis plastica).

It would appear that gastric phlegmon secondary to extensive carcinoma or chronic ulcer of the stomach is less fulminating in its onset and development than the so-called primary cases where no soldering of the loose areolar tissue has taken place. Perhaps, too, the mechanical rigidity of the induration by preventing peristalsis tends to lessen the spread of the infection. It is interesting to note that the cellulitis quite uniformly ceases abruptly at the pyloric ring and at the cardia. This fact is exemplified by Case I of this report and, *per contra*, the fulminating character of the inflammation in Case II, in which the ulcer was exceedingly acute and Case III, in which there was no discoverable lesion, left no room for speculation as to the presence of any inhibitory influence.

It seems probable that in the great majority of cases the streptococci enter the stomach through some lesion of the mucous membrane, but localization in the cellular tissue of the stomach of blood-borne bacteria would seem to occur with some degree of probability because it would be difficult otherwise to account for such cases as those reported by Dittrich (*loc. cit.*) where foci occurred in the retroperitoneal and perirenal connective tissue and beneath the skin in cases of gastric cellulitis. But these again are postmortem findings.

Bossart (*Corres.-Bl. f. sch. Aerzte*, 1912, p. 421) thought that the streptococci enter through the squamous epithelium at the cardiac orifice. In Case III of this report (fulminating, diffuse

phlegmon) the inflammation appeared to be oldest near the cardia, for in this area alone there was a deposit of fibrin on the peritoneal surface of the stomach. Cheinisse emphasized the occurrence of phlegmonous gastritis in infectious diseases, notably erysipelas, and Schwartz in infections of the tonsils. Vasilewsky (*Russkiy Vrach.*, 1915, abs., *Jour. Am. Med. Assn.*) published a typical case in which erysipelas spread to the mouth and pharynx, then to the esophagus and stomach. Lehnhoff recently (*Jour. Am. Med. Assn.*, March 31, 1917) reported a case in a man, aged sixty-three years, with acute sore throat, in whom after six days, severe chill occurred with nearly continuous vomiting (not bloody), pain in left epigastrium, rise in temperature to 102°, pulse 120. A dose of castor oil was given and was followed by large fluid evacuations but the pain and epigastric tenderness was increased. Operation performed to relieve the progressing peritonitis showed stomach covered with fibrin. There was no ulcer and no cancer. The patient died twenty-four hours later.

It is interesting to note that in this case in spite of the extensive infiltration of its wall the stomach responded to the stimulation of the cathartic.

Other cases comparatively recently reported are those of Emge (*Tr. Chicago Path. Soc.*, 1914), of Glascock, and of Fink and Oliver (*Tr. Chicago Path. Soc.*, 1916, and *Boston Med. and Surg. Jour.*, November 30, 1916), and Tuxen (*Hosp. tidende*, Copenhagen, August 2, 1916, lix, No. 31). See also Mintz (*Deutsch. Arch. f. klin. Med.*), Lehnhoff (*Jour. Am. Med. Assn.*, March 31, 1917, lxix), Adams (*Lancet*, 1910).

Emge's case occurred in a man, aged sixty-seven years, while in Cook County Hospital for fractured clavicle. Twelve days after entering he was suddenly seized with epigastric pain, an hour or so later he started to vomit profusely. Examination revealed rigidity, tenderness, and tympany; temperature rose to 106°; pulse feeble; death next morning. Autopsy, five hours later, showed typical so-called primary gastric phlegmon; greenish pus exuding from cut sections of the stomach containing

pure culture of streptococci; no primary focus detected. Emge published an excellent photomicrograph of cross-section of the stomach showing the enormous thickening of the submucous connective tissue.

Fink and Oliver's case was a male, aged fifty-eight years, convalescing from operation for double inguinal hernia eleven days before, who developed suddenly symptoms suggestive of peritonitis in the upper abdomen; temperature 99° rising to 102°; pulse 96 to 130. Operation showed the stomach thick. The stomach was drained but the patient died eight hours later. Streptococci were found and no primary focus of infection was made out.

Tuxen claimed that his case was the third on record in which the diagnosis was made before operation or autopsy. The patient was a previously healthy young man under medical observation for measles when he was seized with sudden severe epigastric pain followed by persistent vomiting, paresis of the intestine, and high fever. Operation established the diagnosis, the stomach was drained but death followed in three days. Tuxen advises operation in suspected cases but deprecates doing anything further if the diagnosis is verified.

Kemp (*Diseases of Stomach, Intestines and Pancreas*, 1917) advises laparotomy for diagnosis and relief if possible; if patient does not consent to operation then the use of ice-bags to the epigastrium, rectal feeding, enteroclysis to relieve tympanites, proctoclysis for sepsis and thirst, opiates as necessary.

For the purpose of determining therapeutic indications with the prognosis in view it would seem that the cases should be divided into three roughly distinguishable groups:

1. Cases with localized abscesses (the most favorable).

2. Cases with minute multiple abscesses in the presence of inhibitory induration.

3. Cases of widely diffuse cellulitis (the least favorable).

In the first group the indication is clear; viz., to open the abscess and drain. In the third group the indication is equally clear: to perform total gastrectomy without opening the infected

areas if the patient is in reasonably good condition so that there is a chance of success, otherwise to close the abdomen without doing anything further in a surgical direction.

In the second group the surgeon will be put to it to determine the best course to pursue; whether to do a partial or a total gastrectomy. If partial gastrectomy is done the line of section should pass far from the line of palpable induration and beyond any edematous or reddened areas for, otherwise, as occurred in Case I of this report, the suture line will break down.

Gastro-enterostomy would seem to be contra-indicated except as preliminary to a possible gastrectomy.

In groups two and three drainage would seem to be useless unless it were mechanically possible to open the stomach in some uninfected area, or, if the cellulitis be diffuse, opening with a cautery knife and then slitting the mucous membrane in several places from within the stomach in order to make possible internal drainage, closing the wound in the stomach and draining the region with a gauze pack. I do not know of any such procedure having been attempted.

Of the 3 cases here reported the first occurred in 1909, the 2 others in the winter of 1916–17, during a period in which many physicians of San Francisco had under their care a rather unusual number of severe streptococcic infections, particularly streptococcic sore throats protracted in their course and followed by many pyemic and suppurative sequelæ.

Case I.—Seen with Dr. E. Schmoll:

Large, thin-walled carcinomatous ulcer with secondary cellulitis. Woman, aged fifty-six years, with history of long-standing indigestion without pain, but with some discomfort generally relieved by eating.

About December 12, 1909, consulted physician for epigastric pain. There was local tenderness, and slight rise of temperature. A week later, after catharsis, palpable thickening was made out above and to the left of the navel; movable on respiration; no muscular spasm; leukocytes, 12,000 to 15,000; temperature 100° to 101°; very little depression.

December 22. Temperature, 102°; leukocytes, 19,000; tenderness more marked. Operation advised.

December 23. Leukocytes, 24,200. Operation: median incision. Stomach found contracted; vessels on its surface engorged; many enlarged bright red lymph glands in lesser omentum and a few in greater omentum. The palpable tumor was the thickened posterior wall of the stomach, but the anterior wall was also somewhat thickened in the region of the pyloric antrum. Lesser peritoneal cavity free, no adhesions, but posterior wall of stomach was covered with fibrin. The stomach after washing was opened. The posterior wall was the seat of an enormous ulcer. The distal three-fourths of the stomach were then removed, the section being made well beyond the line of palpable induration and apparently in normal tissue; union with the duodenum, which was long, as in the Billroth gastrectomy No. 1. The operation, which lasted nearly two hours, was well borne; pulse was under 110 when patient left the table.

December 24. Pulse gradually rose to 140 in the afternoon, without rise in temperature; patient was given fluids by rectum. The condition gradually improved until December 27. Patient was then allowed water by mouth. Temperature, 99°; pulse, 120 to 130; respiration, 30.

December 30. Tumefaction beneath suture line; stitches removed.

December 31. Great amount of seepage; stomach evidently perforated; no peritonitis.

January 2. Several sloughs of stomach wall came away through the open incision. Patient fed by catheter passed down duodenum; digestive fluids regurgitated into wound.

January 7. Severe hemorrhage from region of pancreas; repeated in the night.

January 8. Patient died on seventeenth day after operation and twenty-eighth after onset of inflammatory symptoms.

The pathologist, Dr. Ophüls, reported on the excised portion of the stomach as follows: Large flat ulcer with fairly clean, smooth floor and indurated base. Edges elevated and infiltrated

with soft, grayish tumor which extends near to the edge of the specimen and in one place apparently beyond. In the tissue at the base and along the margin of the ulcer there are many bright yellow miliary abscesses. The tumor is typical adenocarcinoma.

Commenting on this case I would say that it was much less fulminating in its development than most such cases, perhaps because of the resistance offered to the dissemination of the streptococci by the contracting stroma of the tumor. I believe the prognosis would have been better had total gastrectomy been performed instead of so extensive a partial gastrectomy, this because of the difficulty of defining the limits of the carcinoma and of the cellulitis, especially also because the duodenum was long and would readily have reached the cardia.

CASE II.—Stanford Service in San Francisco Hospital. Acute hemorrhagic ulcer with cellulitis.

Man, aged fifty-four years, white, single, brought to hospital August 29, 1916, vomiting blood; temperature, 101.2°; pulse, 84; respiration, 20; apparently in desperate condition; able to give but a meager history. Heavy drinker for years; drank mostly beer; less during last year; digestion good until within one month, when he began to have occasional burning pain in abdomen; vomited occasionally, lost twenty-five pounds in weight; for the last week vomited blood frequently and rapidly; became weak and short of breath; no food retained during last two days; taking food seemed to have no effect on the burning pain. Blood-pressure, 150 to 100 mm.

August 30. Vomited large quantity of blood in early morning. Blood-pressure, 100 to 80. Hemoglobin, 60 per cent. Leukocytes, 31,000. Abdomen tender all over; most in upper right quadrant. Diagnosis: acute ulcer of stomach, with peritonitis.

Operation. Nitrous oxide; a little ether. Midline incision in epigastrium; indurated; inflamed area 6 cm. in diameter in greater curvature; hypodermic needle brought pus from thickened area; resection of distal half of stomach; posterior gastro-enterostomy. Duration of operation one hour and a half; patient very weak;

salt solution under skin; camphorated oil, etc. Death four hours after operation.

Dr. Ophüls described lesion in excised portion of stomach as hemorrhagic necrosis of stomach wall 3 cm. in diameter, surrounded by phlegmonous inflammation; smear showed few diplococci; Gram +; culture: pure growth of streptococci.

Autopsy findings chiefly negative as bearing on the etiology of the gastric phlegmon; small amount of bloody fluid in right pleura; terminal bronchopneumonia. Tonsils atrophic, but smears from them showed many Gram + diplococci and other bacteria; cultures many diplo-streptococci and few of Staphylococcus aureus. Heart valves showed no bacteria; lungs, long chains of streptococci.

CASE III.—Diffuse fulminating phlegmon following sore throat. Seen with Dr. Howard Adler:

Woman, aged forty years, single; domestic; strong, hearty, hard working; general health good, save only for an occasional bilious attack, which led her to take a great deal of Pluto water.

December 22, 1916. Caught cold; took a dose of aspirin.

December 26. Not feeling well she took castor oil; vomited and then had great abdominal pain; bowels moved.

December 27. Vomited all day. Enema brought little result.

December 28. Tried to go to work but soon had to give up; then consulted the physician. Temperature, 99°. Vomited several times; unable to take food. Shortly after noon had severe pain exactly in the midline; not radiating; epigastrium soon becoming tender; a little cough, especially on taking deep breath. Complained of feeling very tired; slight cyanosis.

4.30 P.M. Temperature, 102.6°; respiration, 36. Leukocytes, 10,200; polynuclears, 98 per cent. Slight resistance in epigastrium; borborygmus absent; sticky rales at bases of both lungs.

8 P.M. Cyanosis slightly increased. Patient said she felt better, but tenderness pronounced and sharply localized in midline below xiphoid; occasional hiccough; pulse, 100 to 110. Blood-pressure, 110. Leukocytes, 14,700; polynuclears, 98 per cent. Urine dark, nearly solid on boiling.

Diagnosis lay between basal pneumonia, acute pancreatitis, and gastric phlegmon. The process in the lungs was bilateral and did not seem extensive enough or pronounced enough to account for the great prostration or the local tenderness, and pancreatitis in cases with such prostration is apt to give a higher leukocytosis with less fever.

Exploratory operation; midline incision under local anesthetic showed considerable free fluid in the peritoneum; stomach thick, feeling like a great inert slab of liver an inch thick. Patient complaining of pain was given a little gas and oxygen and ether; incision enlarged; stomach seen deeply congested; thickened from pylorus to cardia; lymph glands in omentum large and red; much fibrin on anterior wall of stomach near cardiac end. The posterior surface of the stomach presented the same picture. A hypodermic needle brought muddy pus from the stomach wall; incision showed the muscle thick and edematous; submucous connective tissue much thickened; necrotic and full of pus. Stomach opened. Interior was fiery red. A small portion of stomach wall was excised for examination. Stomach showed no power of contraction; it felt inert, heavy, lifeless. Multiple drains were inserted and the wound closed. Cultures and smears showed streptococci in pure culture. Death twenty-four hours later.

Autopsy one hour after death. No macroscopic evidence of peritonitis, but smears from areas near the stomach showed streptococci; no bacteria in smears from cut surfaces of liver, spleen, kidney, or pancreas. The inflammatory process (swelling and suppuration) of the stomach wall was sharply limited at the pylorus and at the cardia; pancreas normal; lungs showed simple congestion at the base; liver, a moderate degree of fatty degeneration; kidneys, a few areas of cellular infiltration in the cortex.

When the stomach was laid open careful search failed to show any discoverable lesion of the mucous membrane.

DISCUSSION

Dr. Ellsworth Eliot, Jr., New York City:

In connection with this subject, I should like to call attention to the association of this lesion with purpura hemorrhagica. A case of this character was admitted to the Presbyterian Hospital some years ago which, besides a few purpuric spots in the subcutaneous tissue, presented the subjective and objective symptoms of perforation of the stomach. An exploratory incision was made into the abdomen and the anterior wall of the stomach for a distance of a silver dollar was entirely lacking. The margins of this orifice were sewed into the abdominal incision in an endeavor to make a temporary gastrostomy. The patient died in twenty-four hours, and at autopsy the lesion had not only advanced to the contiguous portion of the anterior wall but the posterior wall was gangrenous as well. Whether this lesion comes under the head of cases referred to by Dr. Rixford is difficult to say. It was, at least, a condition of gangrene of the stomach of a most rapidly developing type, in which the fatal termination was hastened by the exploration.

DILATATION OF THE HEART, WITH ACUTE MYOCARDITIS, FOLLOWING ABDOMINAL OPERATIONS

By EDGAR A. VANDER VEER, M.D.
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Not infrequently in consultation with our fellow practitioners in medicine, and perhaps bearing upon some particular proposed operation, we are told of the "tobacco" heart—the heart carrying a high blood-pressure, the heart associated with chronic alcoholism, the hypertrophied heart, and the irritable or fatty heart—the heart believed to be undergoing fatty degeneration, and which may be attributed to some infective disease through which the patient has recently passed. Also, we are told by the family physician, in the argument presented, that he had considered the case not a proper one for surgical intervention. Habits and environment may be brought into consideration. Conditions present in other organs of the body are discussed. Valvular lesions are so thoroughly understood as to be well recognized as factors of danger in surgical intervention. This clearness of diagnosis, however, teaches the surgeon the care to be exercised in his operative treatment. His favorable prognosis occasionally will bring under consideration one of the conditions that may be presented later, and of which I desire to speak, namely, myocardial conditions, or, as it is so generally referred to, myocarditis and acute dilatation of the heart.

To have completed a successful operation, and when all is apparently going well with the patient, to be called, perhaps as soon as thirty-six hours or any time within two weeks, to the bedside of this surgical case, and to note the train of symptoms

plainly found to be myocardial; that is, heart area greatly increased, pulse rapid and intermittent; apex beat weak, diffuse, patient restless and presenting an unexplained state of anxiety; does not complain of any acute pain—with these conditions one is brought into that intense atmosphere of anxiety of which our older surgeons used to speak in connection with immediate or secondary postoperative hemorrhage. But much more helpless are we surgeons of today. Referring especially to abdominal surgery, the success of today is so great that when we meet a sudden, unexpected death it becomes our duty to study carefully the causes producing such a result.

Are there in some cases foci of infection resulting from the operation which are aroused to activity and attack the heart muscle as a line of preference?

My wish in this short paper is to report a few cases very distressing to me in my surgical work. A series of abdominal operations occurring in my service at the Albany Hospital, which were followed by acute myocarditis, first attracted my attention to this coincidence. Since then I have observed that in gall-bladder or appendix infection which has existed for any length of time, even though no apparent heart symptoms appeared before operation, they did in a certain percentage appear soon after in a greater or lesser degree. I have not observed this phenomenon following other abdominal operations, but I see no reason why it might not occur.

In Billings's work on *Focal Infections* he quotes some experiments conducted by Dr. Rosenow, in which the relation of certain strains of bacteria found in the gall-bladder produced an acute myocarditis when these bacteria were injected into an animal. Outside of the reports of these experiments, and a paper by Dr. Robert H. Babcock, of Chicago, published in *Jour. Am. Med. Assn.*, of June 12, 1909, and later in the *Southern California Practitioner* for March, 1911, entitled "The Effects of Chronic Cholecystitis on the Heart," I have been unable to find anything in the literature upon this subject, and absolutely nothing from a surgical stand-point. In his paper Dr. Babcock

cites a series of cases of myocarditis which were associated with chronic gall-bladder disease and which were greatly benefited by operation upon the gall-bladder.

I append here a few histories in which operation upon the gall-bladder or appendix was followed by symptoms of acute myocarditis and acute dilatation of the heart.

CASE I.—J. G., aged sixty-four years; lawyer. Always in good health. Operated upon for an acute gangrenous appendix; symptoms extending over a period of forty-eight hours. Before operation systolic blood-pressure was 160 mm., diastolic 110 mm. Pulse full and regular, sixty to the minute. Anesthesia and operation uneventful. No unfavorable symptoms for the first sixty hours after operation, then gradual increase in pulse-rate from 60 to 110; respirations 24 per minute; heart sounds rather distant; many of the clinical symptoms of an acute myocarditis. Treatment consisted of low enemas and the administration of digitalin. Patient gradually recovered; the wound healed promptly, showing no signs of infection. Three months after operation heart had returned to its normal condition and pulse regular. Complete convalescence established.

CASE II.—Mrs. S., aged fifty-three years; widow; housewife. History of gall-bladder trouble for several years. Operation for cholelithiasis; several gall-stones removed. Anesthesia well borne and field of operation did not present any unusual complications. For the first thirty hours no unfavorable conditions, then all the symptoms of acute myocarditis developed, and the patient died twelve hours later. This patient presented a severe example of mental depression, saying that she did not believe she would recover from an operation. Such a result is most distressing to the operator and to the friends. In cases of malignancy, and where we have serious lesions with which to deal, we are prepared somewhat for a percentage of mortality, but an unexpected death is not easily forgotten. Unfortunately, such a result mitigates against securing an autopsy, this being the case here; her friends were overwhelmed by the result.

Case III.—Mrs. A. A., aged sixty-eight years; married; housewife. History of gall-bladder trouble extending over several years. Operation for cholelithiasis and cholecystitis. Anesthetic presented no unpleasant complications, and operation completed without embarrassment. Gall-stones removed and gall-bladder drained. Heart action normal. Patient progressed nicely for first fifty hours, when symptoms of acute myocarditis with dilatation of the heart presented. Slow and rather stormy convalescence.

Case IV.—Mrs. P. B. M., aged sixty-two years; married; housewife. Operation for chronic cholecystitis and cholelithiasis and acute appendicitis. No complications. Ether and operation uneventful. Heart normal. Case progressed normally for sixty-five hours, when quite unexpectedly dilatation of the heart, with symptoms of acute myocarditis, appeared. Prolonged convalescence.

Case V.—J. M., aged sixty-two years; blacksmith. No clinical evidence of myocardial trouble. Operation for cholelithiasis. Etherization and operation well borne. Case progressed favorably for seventy hours, when symptoms of acute myocarditis, with dilatation, presented. Patient responded rather tardily to treatment, but finally recovered.

Case VI.—Mrs. R. M., aged sixty-four years; widow; housewife. Typical symptoms of cholecystitis extending over a period of years. Physical examination: heart and lungs normal. Operation: draining of the gall-bladder and appendectomy. Did nicely for fifty-five hours, when symptoms of acute myocarditis intervened and convalescence was greatly prolonged.

An analysis of these cases presents the fact that physical examination of the heart before operation revealed no symptoms of myocardial trouble. Etherization in every case was without unfavorable symptoms. All recovered from the immediate shock of the operation and were well on their way to recovery when the symptoms of acute myocarditis appeared: None of the cases gave a history of any heart lesion. None of the wounds, blood examination, or symptoms gave any indica-

tion of septic infection. Apparently the operation excited germs which were in the gall-bladder, and they secondarily invaded the heart muscle. This is in keeping with the views expressed by Rosenow.

With one exception all these cases were elderly people, who had suffered several years with gall-bladder symptoms, so that it is very possible this condition of acute myocarditis might have been the result of the long period of suffering and the shock of the operation. However, in cases of other abdominal conditions I have not observed this postoperative complication so marked. Therefore is it not reasonable to assume that the acute myocardial symptoms in these cases were due to a secondary infection?

Pathological study of these cases, as presented in the laboratory reports, is interesting. In these, as well as others, we have brought to our attention many etiological factors only recently understood, and all emphasizing the benefit resulting from the laboratory research work. I am of the impression, particularly in our cases of appendix and gall-bladder operations, that a careful and thorough examination of the secretions should be made promptly after operation, and a record preserved, to be of aid in treatment should symptoms of myocardial involvement present.

In these cases of cholecystitis the gall-bladder was drained only. What the effect might have been if a cholecystectomy had been done, I, of course, cannot say with any degree of certainty, and this involves the question of cholecystectomy *versus* cholecystotomy. In a few other cases not here reported, where the appendix was removed, acute myocarditis followed in like manner.

Would it not be advisable to develop a stock vaccine or antitoxin from the gall-bladder or of other abdominal organs involved and use it in cases of this sort? At the present time I am outlining a series of experiments to be conducted at the Bender Hygienic Laboratory along these lines, with the view of developing a vaccine or antitoxin for this distressing complication.

When we feel quite sure that acute symptoms are liable to follow surgical intervention, possibly we might vaccinate the patient before operation. This would be in all cases with long-standing gall-bladder or appendix conditions.

As mentioned above, in Billings's work on *Focal Infections*, he speaks of a strain of streptococci, isolated by Rosenow, which inhabit the gall-bladder and secondarily causes acute myocarditis, also of strains of streptococci in other organs and tissues of the body. Therefore, why is it not probable in these chronic gall-bladder and appendix cases doing an operation excites these peculiar colonies of streptococci, starts them on their journey, and causes acute myocarditis? We all know that the diseased tonsil is occasionally followed by acute secondary infections in other parts of the body. So in the same way operation upon the diseased gall-bladder and appendix, when the right strain of bacteria is encountered, causes acute myocarditis. Just how this condition can be recognized and prophylactic measures adopted I am unable to say. Undoubtedly, cultures from the bile might be made from every case of cholecystitis, appendicitis, or other abdominal disease and held in reserve in case any myocardial symptoms appear.

My impression is that acute myocarditis following abdominal operation occurs more frequently than commonly supposed, and should always be watched for. Is it probably due to streptococci latent in the gall-bladder or appendix, with a selective affinity for the heart muscle, as described by Rosenow?

In considering these few cases to which I have referred, their being one death—postmortem not allowed—it has occurred to me that I might gather some additional facts in looking over the records of the following autopsies, secured at the Bender Laboratory, which have a direct bearing upon the relations between the condition of the gall-bladder found and that of the heart.

In the study of these eight autopsies, bearing directly upon the gall-bladder conditions, without operation, made at the

Albany Hospital and elsewhere, during a period of five years, the following conditions are to be noticed:

There were 5 males and 3 females; ages seventy, seventy-two, sixty-two, fifty-six, sixty, forty-seven, and forty-two (one age or condition not stated). Jaundice present in 6 cases.

CASE I.—Male, aged seventy years; acute and chronic cholecystitis. Gall-bladder distended, adherent, and contained thick yellowish-brown fluid and twenty-one gall-stones. Heart 320 grams, otherwise negative in gross appearance. Microscopic examination not completed. It will be observed that the heart in weight was above normal. Cause of death recorded: chronic cholecystitis.

CASE II.—Adult female, bronchial pneumonia, of which she died. Gall-bladder wall greatly thickened; two large masses resembling burs found. Cystic duct entirely occluded. Heart: right markedly dilated; myocardium brownish in color.

CASE III.—Female, aged seventy-two years; jaundice. Gall-bladder small with many adhesions; two large round stones. Heart 220 grams; muscle flabby; dilated right heart. Microscopic: fibrous myocarditis. Cause of death: carcinoma of the liver.

CASE IV.—Male, aged sixty-two years; jaundice. Patient died within a few hours after entering the hospital. There was found acute cholecystitis, with perforation, fifty faceted calculi. Acute general peritonitis. Heart normal. Cause of death: general peritonitis.

CASE V.—Female, aged fifty-six years; jaundice; died of pulmonary edema. Gall-bladder very adherent; many small gall-stones, one in hepatic duct. Edema of lungs very pronounced. Heart walls collapsed; musculature brownish color, soft, and flabby. Microscopic: apparent edema; few lymphocytes scattered about. Cause of death: edema of the lungs.

CASE VI.—Male, aged sixty years. Gall-bladder small; adherent; several faceted gall-stones. Heart dilated, mitral and aortic thickening, with calcification; coronaries slightly sclerosed; weight 450 grams. Cause of death: acute dilatation of the heart.

CASE VII.—Male, aged forty-seven years. Gall-bladder thickened, filled with mucopurulent material; many stones present; ducts obstructed; acute hepatitis. Heart cavities normal; musculature flabby; coronaries negative. Microscopic: chronic fibrous myocarditis; subacute pericarditis. Cause of death: subacute myocarditis.

CASE VIII.—Male, aged forty-two years; jaundice. Gall-bladder distended with bile; ulcerated; acute and chronic hepatitis. Heart, both sides flabby; muscle soft and pale. Increased fibrous tissue, numerous leukocytes, few plasma cells and polynuclear leukocytes. Microscopic: acute and chronic myocarditis. Cause of death: subacute myocarditis.

While these cases may be of little value, I feel somewhat hopeful that something to aid in our future early recognition of acute dilatation may develop and operative surgery meet with less of the few remaining defeats that may be our lot to come in contact.

They also carry out the conclusions so well expressed by Dr. William J. Mayo, that "Gall-stones may be considered foreign bodies, and, other things being equal, the earlier these foreign bodies are removed the better for the patient."

DISCUSSION

Dr. John E. Summers, Omaha:

Were any blood cultures made in these cases? How could their diagnoses be established without blood cultures? We may have these disarrangements of the nervous mechanism of the heart following any serious operation: there may be dilatation, irregular tachycardia, etc. Without blood cultures I do not think a positive diagnosis of secondary infection of the heart can be established.

Dr. Ernest A. Codman, Boston:

What would you recommend as treatment in such a case?

Dr. Frederick N. G. Starr, Toronto, Canada:

About eighteen months ago one of our senior students was taken, not acutely ill, but happening to meet him in the corridor and noticing he looked unwell I suggested he have his temperature taken. It was found to be 103°. He was immediately put to bed and a possible myocarditis diagnosed. In twenty-four hours a very definite endocarditis was present, with a positive blood culture. On the third day I was asked to see him because he had some distress in the abdomen. By the time I saw him he had definite signs of appendicitis. I removed an acutely inflamed appendix, from which we cultured the Streptococcus viridans, injected it into the blood stream of the rabbit, and this rabbit died in twenty-four hours, showing an endocarditis, with petechial hemorrhages, from which we recultured the streptococcus.

Dr. Edgar A. Vander Veer, Albany (in closing):

I would like to say that unfortunately we did not make any blood cultures and the diagnosis was made on the clinical symptoms solely. The usual treatment of myocarditis, using digitalis for the heart, etc., was employed.

THE OPERATIVE INDICATIONS IN HOUR-GLASS STOMACH

By WILLIAM A. DOWNES, M.D.
NEW YORK CITY

THE observations set forth in this paper are based on the operative results obtained in 17 cases of hour-glass contraction of the stomach following benign ulcer. I realize fully that this number of cases is far too small to justify positive statements, but the fact that 15 of them have been observed for an average period of two and a half years after operation and 1 for more than nine years at least permit an opinion as to the comparative value of the various operative procedures employed. There were 16 females and 1 male in the series. The average age was thirty-nine years. There was 1 operative death—the seventeenth case dying from pneumonia—on the sixth day after mediogastric resection.

Before the *x*-rays came into general use as an aid to the diagnosis of stomach lesions, hour-glass contraction was considered to be somewhat of a novelty and was usually discovered after the abdomen had been opened. The various means at our disposal prior to the advent of the bismuth meal, such as distending the pouches with gas, lavage, etc., occasionally suggested such a deformity of the stomach, but a positive diagnosis could rarely be made. Well-taken radiograms not only establish the diagnosis at once but give a fairly accurate idea as to the relative size and shape of the pouches, the width of the channel connecting them, and the condition of the pylorus. This infor-

mation gained beforehand is of great assistance to the surgeon in determining the operative procedure best suited to a given case.

The one absolute requirement of any operation employed in the treatment of hour-glass contracti n is that the symptoms due to obstruction be relieved. If at the same time the procedure adopted can include excision of the ulcer or the cicatrix of a healed ulcer, without too great a risk, so much the better; but the fact must not be lost sight of that the great majority of these patients come to us on account of weakness due to inability to take or retain sufficient food. Pain has become an old story with them, and in many instances causes little alarm until vomiting and loss of weight appear. A severe hemorrhage was the immediate cause of one of our patients coming to the hospital. This was the only case in which there was bleeding of any consequence.

At least four operative procedures—gastro-enterostomy, gastroplasty, gastrogastrostomy, and mediogastric resection, or resection in continuity—are available in the treatment of hour-glass contraction. To these pylorectomy should be added as the method to be adopted if the constriction is near the pylorus, thus forming a small distal pouch. We have had no case of simple stricture in which the latter operation seemed to be indicated and for this reason are not in a position to discuss its merits.

Gastro-enterostomy is the operation most generally used for the relief of this condition. This procedure alone was employed in 6 of our cases and was combined with gastroplasty in a seventh. It is hardly necessary to state that, as a rule, the intestine should be anastomosed to the cardiac pouch. As an exception Case 11 is cited. In this instance the constriction occupied the middle third of the stomach and was caused to a large extent by perigastric adhesions. There was marked infiltration of the walls of both pouches, proved subsequently to be syphilitic, with a large retention in the lower pouch and no retention in the upper. After the channel connecting the pouches had been sufficiently freed to admit three fingers the gastro-enterostomy was made

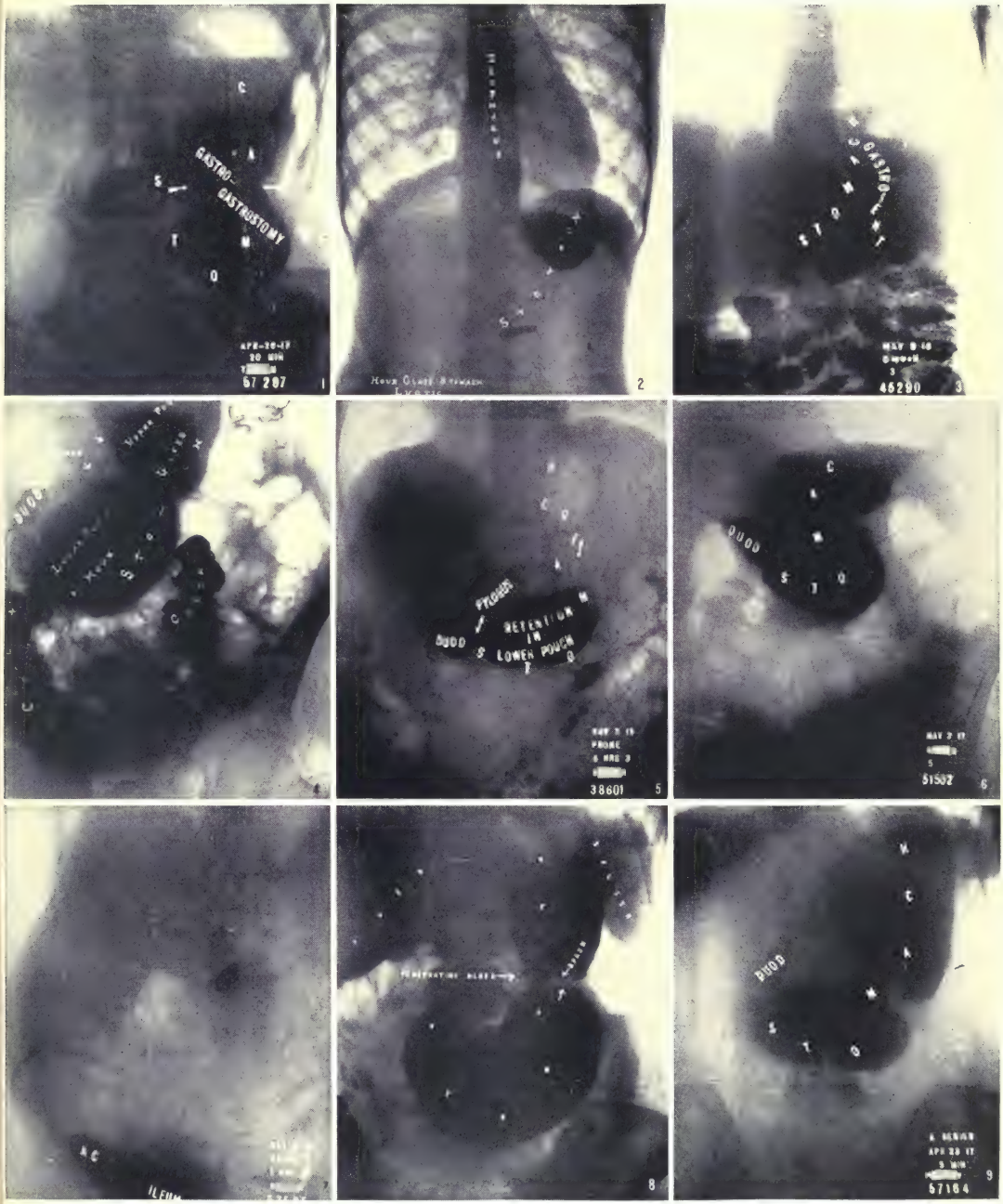

FIG. 1.—Case 1. N. T. Nine years after gastrogastrostomy for hour-glass contraction.

FIG. 2.—Case 2. H. D. Hour-glass stomach, luetic.

FIG. 3.—Case 2. H. D. Three years after gastro-enterostomy for hour-glass stomach.

FIG. 4.—Case 3. R. B. Hour-glass stomach.

FIG. 5.—Case 3. R. B. Two years after gastro-enterostomy. Recurrence of symptoms due to retention in lower pouch.

FIG. 6.—Case 3. R. B. One and a half years after gastroplasty and pyloroplasty.

FIG. 7.—Case 3. R. B. One and a half years after gastroplasty and pyloroplasty. Stomach empty.

FIG. 8.—Case 4. G. M. Hour-glass stomach due to ulcer of lesser curvature.

FIG. 9.—G. M. Three and a half years after excision of ulcer and gastroplasty. Peristence of deformity. Symptom-free.

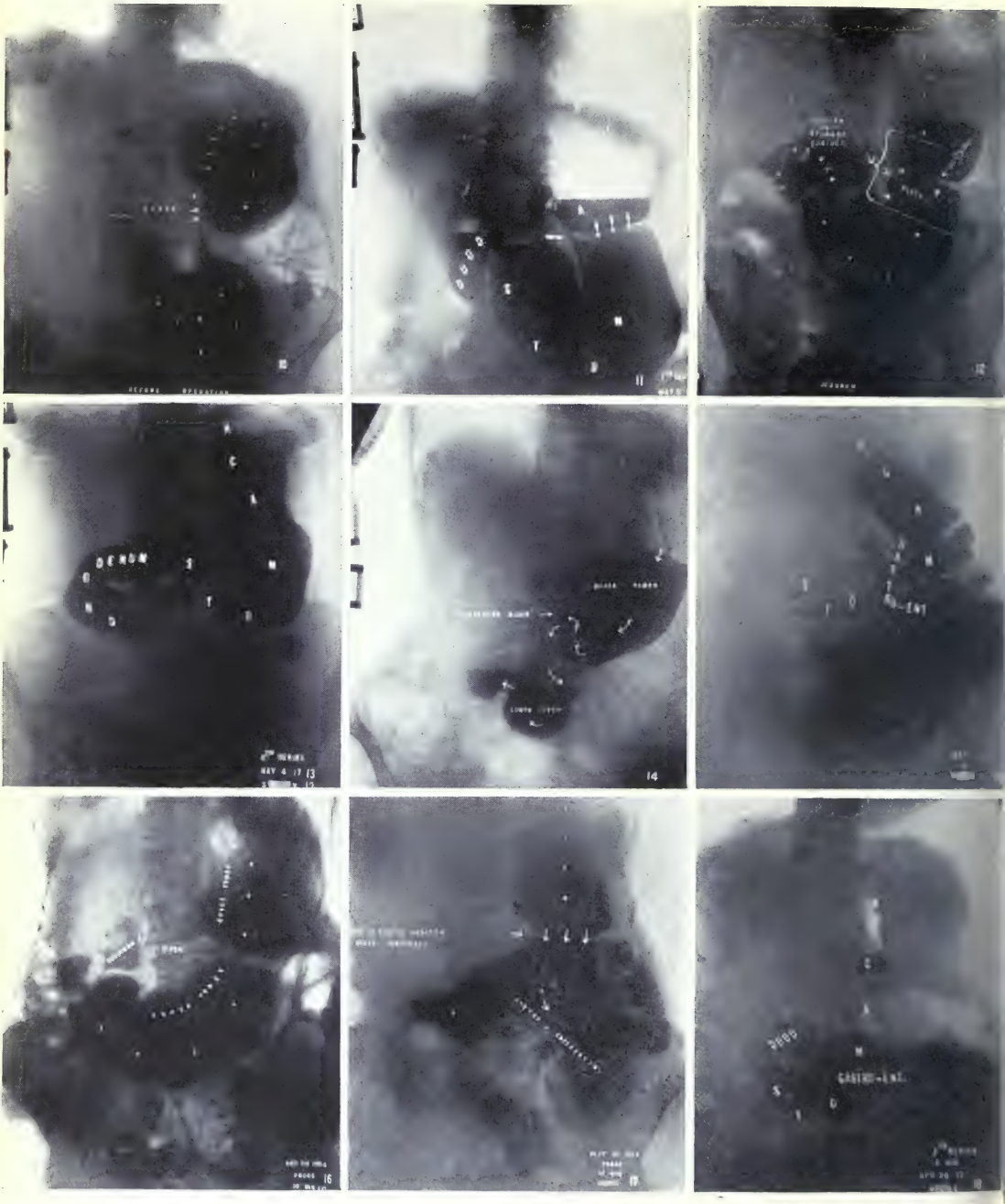

FIG. 10.—Case 5. D. N. Hour-glass stomach due to ulcer.

FIG. 11.—Case 5. D. N. Three and a half years after gastrogastrostomy.

FIG. 12.—Case 6. A. S.

FIG. 13.—Case 6. A. S. Three and a half years after mediogastric resection.

FIG. 14.—Case 7. A. W. Hour-glass stomach with penetrating ulcer.

FIG. 15.—Case 7. A. W. Three years after gastro-enterostomy.

FIG. 16.—Case 8. S. W. Hour-glass stomach due to ulcer.

FIG. 17.—Case 8. S. W. Roentgenogram two weeks after operation. Cauterization of ulcer. Gastroplasty and gastro-enterostomy.

FIG. 18.—Case 8. S. W. Two and a half years after operation.

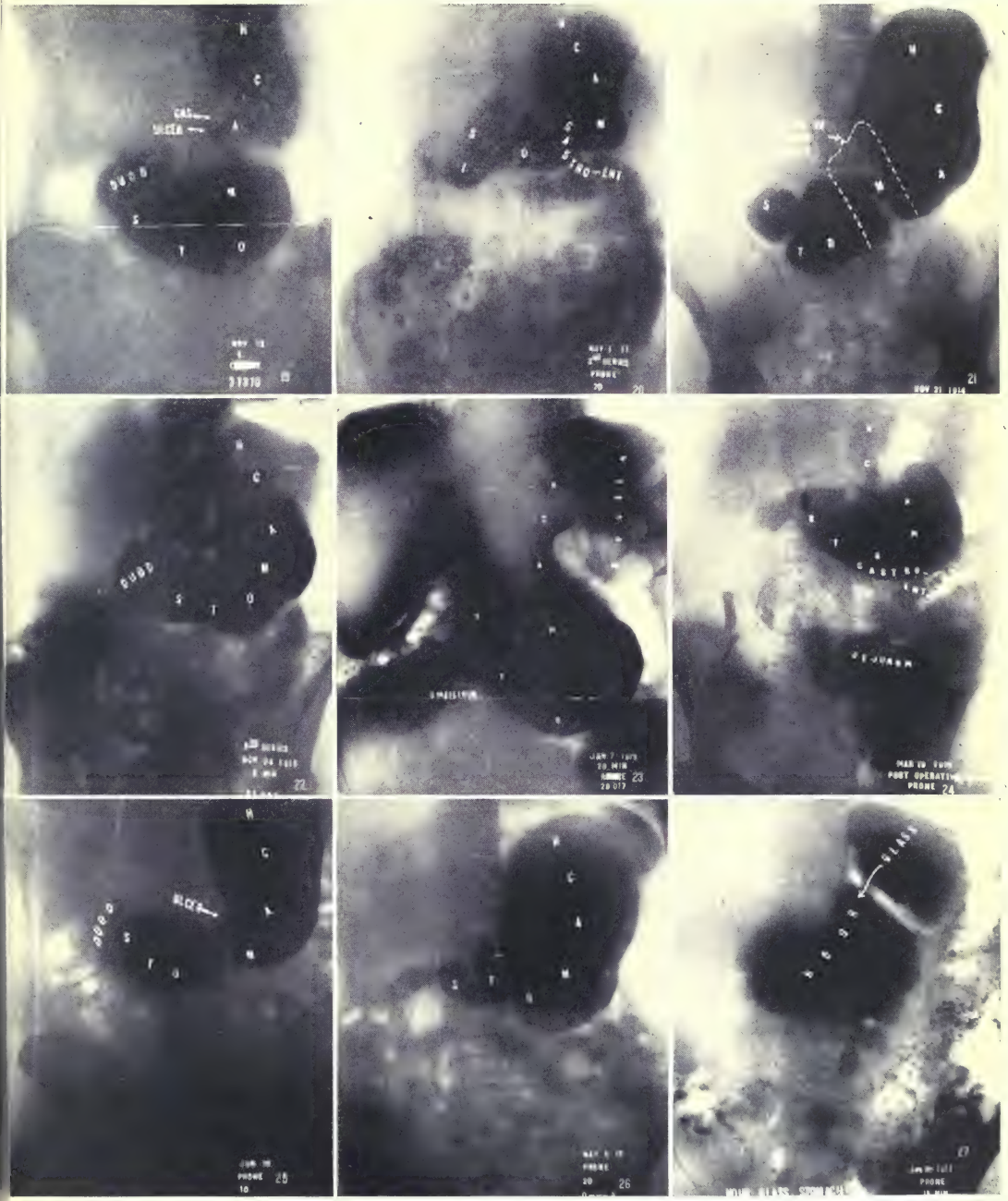

FIG. 19.—Case 9. E. C. Penetrating ulcer of stomach.

FIG. 20.—Case 9. E. C. Two and a half years after gastro-enterostomy.

FIG. 21.—Case 10. E. L. Hour-glass stomach.

FIG. 22.—Case 10. E. L. Two years after mediogastric resection.

FIG. 23.—Case 11. G. R. Hour-glass stomach, luetic.

FIG. 24.—Case 11. G. R. Two months after gastro-enterostomy.

FIG. 25.—Case 12. N. O'H. Hour-glass stomach, ulcer at lesser curvature.

FIG. 26.—Case 12. N. O'H. Two years after gastroplasty with excision of ulcer.

FIG. 27.—Case 13. M. O. Hour-glass stomach.

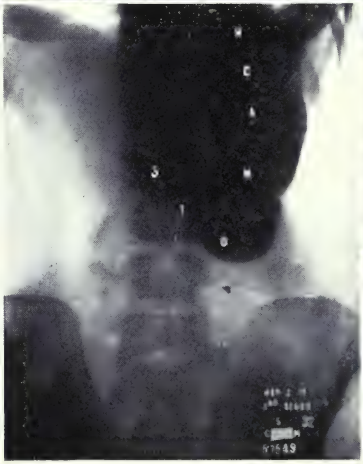

FIG. 28.—Case 13. M. O. One and a half years after gastroenterostomy.
FIG. 29.—Case 14. A. E. Hour-glass stomach.
FIG. 30.—Case 14. A. E. Eight months after mediogastric resection. Persistence of deformity.
FIG. 31.—Case 15. A. G. Hour-glass stomach due to ulcer.
FIG. 32.—Case 15. A. G. Six months after mediogastric resection.
FIG. 33.—Case 16. K. H. Hour-glass stomach due to ulcer.
FIG. 34.—Case 16. K. H. Seven months after gastrogastrostomy.

to the pyloric pouch. The after-history of this patient is interesting in that when she died one and a half years later of a generalized syphilis, all symptoms referable to the stomach had been entirely relieved.

Failure to note stenosis at the pylorus in one case necessitated a second operation to relieve stasis in the pyloric pouch. With this exception the results following gastro-enterostomy have been satisfactory in every way. This operation is indicated in those cases in which the constricted area is of wide extent and in those where adhesions prevent mobilization of both pouches.

Gastroplasty has a limited field in the treatment of hour-glass contraction, due to the fact that it is suitable only for cases in which the pouches are movable, their walls free from induration, and the constricted area narrow. It is simple, easy to perform, and permits direct inspection of the interior of the stomach, thus affording an opportunity for treating an active ulcer by excision or cautery application. It may be combined with pyloroplasty or gastro-enterostomy if the pylorus is stenosed. Four of our cases were operated upon by this method. In 1 the cautery was applied to the ulcer and gastro-enterostomy added, in 2 the ulcer was excised, and in the fourth gastroplasty was combined with pyloroplasty after simple gastro-enterostomy had proved unsatisfactory. It is interesting to note that at the second operation on this patient the stomach wall, which had been indurated at the first, had become soft and pliable, so that the plastic operation was done with great ease. The end-results in this group of cases have been most satisfactory, although in one the hour-glass deformity, to a certain extent, persists to the present time, three and a half years after operation.

Gastrogastrostomy is especially adapted to the cases in which the stomach is adherent along its lesser curvature to the liver, in which the pouches are relatively large, nearly equal in size, and can be approximated at their dependent portions. The stomach wall should be free from induration at the site selected for the anastomosis. The pylorus must be patent, otherwise pyloroplasty or gastro-enterostomy will have to be added.

Gastrogastrostomy was performed in 3 cases of this series with complete clinical recovery in each instance. One of these patients has been followed for nearly nine years.

Mediogastric resection, or resection in continuity, is the ideal operation for hour-glass deformity of the stomach, provided the pylorus is not stenosed, and should be performed in all suitable cases. The ulcerated area, active or quiescent, as well as the constricted portion of the stomach wall, is removed by this method. The end-results obtained demonstrate the value of this procedure. Unfortunately it is limited to the cases with few adhesions in which the pouches are fairly large and permit of free mobilization. It is a longer and somewhat more difficult operation to perform than those already mentioned, and for this reason, if the patient is in poor condition, should not be given preference over them. In order to overcome the tendency for the constriction to persist after resection in continuity a wide excision should be made. The radiograph of one of our cases taken subsequent to operation illustrates the necessity of bearing this point in mind. Midgastric resection was the method adopted in 5 of our cases. In 3 cases a perfect result seems to have been obtained; 1 has worked continuously as a domestic for over three years; 1 for two and a half years; and 1 operated on eight months ago has gained twenty pounds in weight. All symptoms referable to the stomach have disappeared. The fourth case referred to above, in which the radiograph shows a persistence of the deformity, continues to have some distress in her stomach after meals, although there has been no vomiting. She has gained in weight and has continued her work. The fifth case died of pneumonia on the sixth day after operation. This patient was not in good condition, and a less severe operation should have been performed.

The 15 patients of this series surviving to the present time have been examined and checked by radiographs during the past few weeks. All have gained in weight, and with the one exception noted are practically free from the symptoms for which they sought relief.

The radiographs taken at considerable periods of time after operation demonstrate very clearly that the various methods employed have met the prime indication, that is, overcome the obstruction. Whether the results obtained will be permanent in every case remains to be seen, but certainly some of each group have been followed sufficiently long to warrant the claim that a cure has been effected. From a study of the clinical results I have come to the conclusion that each of the four operative procedures above mentioned gives equally good results, provided the correct one is applied in a given case and is executed in a proper manner.

I take this occasion to express my obligation to Dr. L. T. Le Wald, radiologist to St. Luke's Hospital, through whose assistance and coöperation this report has been made possible.

SYNOPSIS OF SEVENTEEN CASES OF HOUR-GLASS STOMACH

Case No. and name.	Sex, age.	Hospital.	History.	Operation, type and date.	Present condition.
1 N. T.	F. 35 yrs.	Memorial	Perforating gastric ulcer excised two years previously; pain and vomiting for past three months	Gastrogastrostomy, November, 1908	Excellent; free from stomach symptoms.
2 H. D.	F. 14 yrs.	St. Luke's	Pain and vomiting for two years; Wassermann 4+	Posterior gastroenterostomy to cardiac pouch, July, 1913	Very good; no pain or vomiting.
3 R. B.	F. 50 yrs.	St. Luke's	Symptoms of stomach trouble for thirty years	Posterior gastroenterostomy to cardiac pouch, September, 1913; return of symptoms due to stasis in pyloric pouch; gastroplasty with pyloroplasty, November, 1915	Satisfactory; no pain or vomiting; large amount of gas in intestines, probably result of adhesions.
4 G. M.	F. 34 yrs.	St. Luke's	Indigestion for many years; acute pain with vomiting for past five weeks	Gastroplasty with excision of ulcer, October, 1913	Good; no vomiting or pain; deformity persists.
5 D. N.	F. 45 yrs.	St. Luke's	Long-standing history; symptoms acute for past seven weeks	Gastrogastrostomy, January, 1914	Very good; no pain or vomiting, although *x*-ray shows considerable six-hour retention.
6 A. S.	F. 28 yrs.	St. Luke's	Vomiting and pain for years	Mediogastric resection, February, 1914	Excellent.
7 A. W.	F. 51 yrs.	St. Luke's	Pain and vomiting for many years	Posterior gastroenterostomy to cardiac pouch, June, 1914	Good; free from symptoms.
8 S. W.	F. 62 yrs.	St. Luke's	Severe pain and vomiting for six months	Gastroplasty, cauterization of ulcer on posterior wall; posterior gastro-enterostomy, September, 1914	Very good; symptoms entirely relieved.

SYNOPSIS OF SEVENTEEN CASES OF HOUR-GLASS STOMACH—*Continued*

Case No. and name.	Sex, age.	Hospital.	History.	Operation, type and date.	Present condition.
9 E. C.	F. 32 yrs.	St. Luke's	Pain for six years; vomiting for few weeks	Posterior gastro-enterostomy to cardiac pouch, November, 1914	Excellent; symptoms entirely relieved.
10 E. L.	F. 29 yrs.	St. Luke's	Pain and vomiting since thirteen years of age	Mediogastric resection, November, 1914	Very good.
11 G. R.	F. 34 yrs.	St. Luke's	Epigastric pain for ten years; irregular vomiting; Wasserman, 4+	Liberation of adhesions; posterior gastro-enterostomy to pyloric pouch, January, 1915	Died one and a half years after operation from a generalized syphilis; result of operation satisfactory.
12 N. O'H.	F. 50 yrs.	St. Luke's	Fourteen years' duration; continuous vomiting for past four months	Gastroplasty with excision of ulcer, June, 1915	Satisfactory; no return of symptoms.
13 M. O.	M. 51 yrs.	St. Luke's	Pain in stomach for three years; symptoms suggestive of carcinoma.	Gastro-enterostomy to cardiac pouch, January, 1916	Good; free from stomach symptoms.
14 A. E.	F. 24 yrs.	St. Luke's	Pain and vomiting for six years	Mediogastric resection, September, 1916	Moderate pain after meals; no vomiting; *x*-ray shows persistent deformity.
15 A. G.	F. 41 yrs.	St. Luke's	Seven years' duration of symptoms	Mediogastric resection, November, 1916	Excellent.
16 K. H.	F. 53 yrs.	St. Luke's	Symptoms for many years; persistent vomiting for past few mos.	Gastrogastrostomy, December, 1916	Very good.
17 H. C.	F. 31 yrs.	St. Luke's	Indigestion for many years; severe hemorrhage three weeks before admission	Mediogastric resection, March, 1917	Died sixth day after operation, from pneumonia.

DISCUSSION

Dr. William J. Mayo, Rochester, Minn.:

Our experience in the operative treatment of hour-glass stomach coincides almost exactly with that of Dr. Downes. I noted that 16 of his patients were females and 1 male. While the percentage was not as great in our cases, females were very largely predominant. As Dr. Downes has shown, the necessary procedure for the relief of hour-glass stomachs in these cases must be judged on individual conditions. Cases of hour-glass stomach may be rather sharply divided into two general groups: (1) Those in which the ulceration has cicatrized, leaving an hour-glass deformity, and (2) those in which large ulcerations are still a complication, especially ulcerations of the body of the stomach, which penetrate through into the pancreas, and at times have craters one, two, or more inches in diameter. These latter conditions are very distressing. While the mechanical conditions of hour-glass stomach are perhaps not so immediately manifest, they are potentially hour-glass if they become healed. But in these cases operative procedures which deal with the anterior wall of the stomach, or a gastro-enterostomy at a point distal to the ulcer, healing is not often accomplished, and the patient may die supposedly from cancer. In a number of such cases we have made the resection in continuity—so-called segmental resection, to which Stewart has especially called attention, and which Dr. Downes found successful in some of his cases. We excised the middle portion of the stomach widely, shaving the base of the ulcer well down into healthy pancreatic tissue. In this way we have been able to cure a certain type of patients which formerly we had failed to cure in a large percentage of cases.

Dr. Charles L. Gibson, New York City:

I would like to speak of one form of treatment of hour-glass stomach which I think ought to receive consideration; it is a procedure seldom employed, that is, double gastro-enterostomy. The procedure was recommended by Weir many years ago. I had occasion to perform it recently, and the case is to be reported by an assistant, and he has only found 2 similar cases. I shall be much indebted to the gentlemen here who have had occasion to treat hour-glass stomach by double gastro-enterostomy for any details from their cases. The operation in its simplicity and speed of performance compares favorably for the graver cases of hour-glass stomach when something more than a

gastro-enterostomy must be done. I would like to report the case of an Irish woman, with acute symptoms, who had a stomach with two very large pouches. X-ray showed retention of the bismuth, and operation five days after the bismuth meal disclosed an enormous amount still retained in the pyloric pouch. The woman was in pretty bad shape; she had at the time of operation a marked septum at the midpoint of the stomach and a tight constrictor at the pylorus. We had to do a double gastro-enterostomy. The anastomoses were made about three inches apart. The results were most gratifying. She never had a symptom, was out of bed in ten days, and gained forty-one pounds in fifty days. This operation is now three months old. This experience justifies me in feeling that I shall certainly perform this operation rather than the more extensive operation in the future. Especially would I suggest that in very ill patients this is the method of choice.

I want to say just a word for the clamps: I hesitate very much to bring up a procedure of my own, but I believe a little procedure that I have called the tongue-depresser clamp has certain advantages over the usual form. As I do the operation with five rows of sutures, three posterior and two anterior, the main point about the clamps is that having completed the third row I release the clamps, and that helps us to operate without any more clamps. Before performing the last two rows of sutures without clamps one can see if there is hemorrhage, usually a little on the last layer to be sutured, so we can deal effectively with the hemorrhage. The most important thing is that we can by having a "free" stomach and intestinal wall on either side very easily invert the layers which come together. I am now making the clamps quite narrow. These clamps are very simple, and I think you will like this method if you will try it.

Dr. Francis T. Stewart, Philadelphia (in closing):

It has occurred to me in connection with hour-glass stomach that an operation somewhat as follows might be applicable, but I have never done it, and therefore it must be received in that spirit. In suitable cases I think it might be a good plan to bring the intestine up between the two pouches and incise it, and then make an opening in each gastric pouch, sew the posterior edge of each gastric incision to the corresponding edge of the intestinal incision, and there unite the anterior edges of the incisions in the stomach. This would serve the purpose of a double gastro-enterostomy and drain both pouches.

INFECTIONS IN PROSTATE CASES

By E. S. JUDD, M.D.
ROCHESTER, MINN.

THE importance of the preoperative treatment and the post-operative care of patients following prostatic operations is well established. A great deal has been done also to improve and simplify the operative technic, so that at the present time the operation is a much more definite surgical procedure than formerly. The element of infection in these cases has received due consideration, although apparently a great deal remains to be learned. In two seemingly parallel cases, one patient may have a very severe infection at any time following the operation. It is an accepted fact that the patient who has cystitis and other evidence of chronic infection at the time of operation is likely to be a better risk and is almost certain to have an easier convalescence than the patient who has a perfectly clean bladder and no symptoms of infection in the urinary tract. This would seem to suggest that the infection had produced a definite immunity, and further, that some benefit might be expected from the preliminary use of vaccines.

In the majority of instances, a very definite and characteristic reaction is brought about by preoperative treatment. Just what the etiological factor of this reaction is has not been decided. It is characterized by general weakness, irritability, inability to rest, and loss of body weight. During the height of the reaction, the specific gravity of the urine and other tests show that the function of the kidney is very much diminished. There is a marked reduction in the blood-pressure, which is usually high.

After the reaction subsides all these symptoms disappear. The renal function apparently returns to normal, although the specific gravity of the urine will probably never reach the point of its first reading. During the reaction there may be much evidence of infection, such as chills, increased temperature, pus in the urine, and in some instances blood cultures will be positive. This infection, if it is an infection, is characteristic. A patient well along in years will withstand a long abdominal operation under a general anesthetic even though there is considerable infection in the operative field, and yet if at any time during convalescence this same patient has retention of urine so that catheterization is necessary for some time, there is almost sure to be more reaction from this procedure than from the abdominal operation. I do not believe we can accept the theory that the reaction which generally follows catheterization and the withdrawal of residual urine is always due to infection alone. The reaction may occur at any time without any evidence of infection and it would seem that it might be due to the change of pressure within the pelvis of the kidney which permits a sudden congestion. This in turn interferes with the renal function.

In the somewhat detailed study of a small series of cases herewith presented the attempt has been made to ascertain as nearly as possible the part infection plays in the reactions which take place during the preparation of patients either by draining the bladder through a urethral catheter or through a suprapubic opening. It has been of interest also to find out just how often infection occurs during convalescence and how much of a factor it is in the convalescence and in determining the mortality.

Infection in the kidney is the most important factor to be taken into consideration. The question arises as to whether many of these patients do not have more or less chronic infection of the kidney from the beginning of the urinary symptoms. An infected kidney does not continuously pass organisms into the urine. An area of infection may be walled off so that the urine is free from pus and organisms except at intervals when the area opens up and discharges into the calyx or pelvis. This is

known to have occurred in several instances; the urinalysis did not indicate any infection in the kidney, although at operation or autopsy considerable evidence of infection was shown. I believe that this is a frequent condition in prostate cases. As soon as any treatment is begun, the infection increases because of the changes brought about in the kidney, and bacteria and pus appear in the urine. The change in the urinary apparatus is made by the withdrawal of the residual urine. When the urine is free from bacteria before treatment is begun but shows pus and organisms a short time afterward, it is usually believed that the infection is due to contamination during treatment. This is undoubtedly true in some cases, but it would seem that the appearance of pus and organisms in the urine does not necessarily mean the treatment has caused an infection. Just why the kidneys become infected and the route by which the infection enters them has been the subject of considerable discussion. Crabtree and Cabot[1] believe that the blood stream is by far the most frequent source of infection. They cite the case of a man under preparation for prostatectomy whose urine at the time of admittance to the hospital was found by culture to be free from infection. The catheter had been in place for several days during which time there were no symptoms and the cultures were sterile. On the eighth day the patient complained of burning in the urethra; two hours later he had a chill and a sharp rise in temperature. Blood cultures made two and a half hours after the onset of symptoms showed a pure growth of colon bacilli. No bacteria were found in the cultures from urine made at the same time, but cultures of the urine several hours later showed abundant colon bacilli. The functional test dropped twenty points in twenty-four hours. The patient presented all the evidences of pyelonephritis, but with constant urethral drainage for another week, renal function returned to within five points of the former reading. At this time a prostatectomy was performed. A secondary hemorrhage occurred on

[1] Crabtree, E. G. and Cabot, H.: Colon Bacillus Pyelonephritis, Jour. Am. Med. Assn., 1917, lxviii, 589-591.

the ninth day and the patient died. The autopsy showed that the kidneys were pale and had normal markings. There was no dilatation of the pelves. Crabtree and Cabot believe this case to have been one of pyelitis and pyelonephritis. The diagnosis of pyelonephritis was based on the sudden drop in the kidney function which they think was due to cloudy swelling probably involving the tubular portion of the kidney. They believe that in such cases perivesical tissue becomes infected, but instead of lymphatic extension to the kidney, which is against all rules, the infection enters by the blood stream.

In some of these cases infection ascending by way of the urinary passages is probably the source of the kidney infection. Ordinarily infection does not occur in this manner, but when there is an inflammatory thickening in the wall of the bladder and also in the lower end of the ureter (especially if there is obstruction in the urethra producing back pressure into the ureter), infection may readily extend to the kidney through the lumen of the ureter.

Infection might ascend by way of the lymphatics if all the lymphatics were blocked but under ordinary conditions, with the lymph draining normally, infection at the lower end of the ureter would be passed to the lymphatic glands in front of the sacrum. It is more likely that the perivesical infection finally reaches the kidney by extending into the lymphatics and then entering the blood stream.

The effect of the infection on the function of the kidney depends on the part of the kidney involved. There may be chills, fever, and considerable pus in the urine, and yet the renal function may not be greatly reduced. On the other hand, with little evidence of infection—no rise in temperature, no organisms in the urine—the renal function may be very greatly reduced. If the infection attacks the cortical part of the kidney, as is usually the case when it is of coccus origin, there will be considerable evidence of it, but the renal function may appear normal. If the infection enters the region of the tubules, even though it causes only a swelling in this region, the phthalein output is

usually greatly diminished. This type of infection is usually produced by the colon bacillus. If the infection is mixed and due to colon bacilli and cocci as well, there will be much pus in the urine, marked evidence of infection and also greatly reduced function.

Infection in the ureter is generally secondary to an infection in the wall of the bladder. The ureter is dilated, the coats are greatly thickened, and there are no peristaltic contractions. The dilatation of the ureter must be due to the increased pressure, and the hypertrophy to the effort to force the urine past the obstruction. The trauma which precedes infection in the bladder and ureter is produced by the overdistention. Cystitis is often due to trauma produced by the catheter.

In the study of these cases bacteriological examinations have been made of the urine and blood and also of the prostate and the wound after operation. In nearly all such examinations, the blood cultures were negative, possibly because of the fact that they were not made immediately following the chill. According to Bumpus, cultures will often not be obtained from the blood a few hours after the chill.

The bacteriological examination of the urine in five consecutive cases in which complete data were obtained showed that before treatment of any kind had been instituted Staphylococcus albus could be demonstrated in the culture in four of them. In one the showing was very scanty. In the fifth case no growth had developed in the media at the end of the fourth day. While all these cultures were taken with great care it is not possible to be absolutely certain they were free from contamination. The presence of the cocci in the urine could not be explained. None of the patients had any rise in temperature or showed other evidence of infection. A second bacteriological examination of the urine was made of three of the five patients four days after the preliminary treatment was begun. The other two did not require preoperative treatment. It is especially interesting to note that in all the cases in addition to the staphylococci that were present at the first examination there were colon bacilli in some or

all of the media. In Cases III and IV, in which a primary prostatectomy had been performed, the urine gave a positive culture of colon bacilli in one case on the fourth day after the operation and in the other on the fifth day, so that all five patients had a colon bacillus infection four or five days after the beginning of treatment. The patient who had a primary prostatectomy was the only one who showed some evidence of infection. On the fourth day he developed a temperature of 101.5°. In two instances cultures were taken of the hypertrophied prostate as soon as it was removed. The culture from the patient who had not had any preliminary treatment was negative. The culture from the patient who had been catheterized for several weeks showed a positive growth of colon bacilli.

The five patients all made good recoveries without complications. They were discharged with wounds completely healed within five weeks after the prostatectomy. Only one patient had a temperature as high as 102°, and this lasted but a few hours. Possibly the convalescence in these cases was better than is usual, yet at approximately the same time after the beginning of treatment, cultures of the urine in each case showed colon bacilli and staphylococci. This would seem to suggest either that these patients had a natural or acquired resistance to these bacteria, or that the bacteria were not especially active. There was no suggestion at any time of insufficient elimination from the kidney. Since positive cultures were found in all these cases does it not seem probable that they are common in this condition? Such cultures point out what will take place if for any reason the patient's resistance is greatly lowered or the activity of the organisms is increased.

Vaccines were not given in these 5 cases. Recently we have made a study of 21 prostatic cases to determine the effect of the use of Bacillus coli vaccines. Twelve of the cases were preoperative and 9 postoperative. Each patient received Bacillus coli vaccine every four days beginning with 50,000,000 and increasing to 500,000,000, the maximum dose. A microscopic examination of the urine was made every week and with

one exception colon bacilli were found. However, none of the 21 cases has shown any evidence of severe infection, and it is possible the use of the vaccine may have modified the infection considerably in spite of the fact that the colon bacilli persisted in the urine. Two of the 21 patients had chills. A blood culture made from one at the beginning of the chill was sterile. Both had white blood counts during the chill showing only about 25,000 leukocytes. The phthalein dropped 10 to 15 per cent. at the time of the chill.

CONCLUSIONS

1. In prostatic cases a definite reaction occurs during the preoperative treatment. In some cases this reaction may be due to infection in the kidney.

2. Several days after the beginning of treatment or after the operation has been performed, in a very large majority of cases the urine shows a considerable number of colon bacilli. This cannot be due to contamination in every instance, although we are unable to say whether it comes from the kidney, the bladder, or the prostate itself.

3. The infection may be walled off in the kidney and therefore no organisms will show in the urine. Simultaneously with any form of treatment, the infection becomes active and the urine immediately shows bacteria.

4. Colon bacillus vaccine may modify the infection, though it does not decrease the number of colon bacilli in the urine.

CASE REPORTS

CASE I (A186131).—S. H., a farmer, fifty-seven years of age; married thirty years; twelve children. Urgency of urination, smarting and burning had existed for eight years and dribbling for three years. There had never been complete retention and a catheter had never been used. The patient had lost fifteen pounds in weight. There was bilateral enlargement (encapsulated) of the prostate, 3 on a scale of 4. The bladder was dis-

tended. The right eye showed secondary optic atrophy; the left eye was negative. A twelve-hour specimen of the urine, 600 c.c., had a specific gravity of 1026, an acid reaction and an occasional pus cell, but was otherwise negative. Combined phthalein test: 260 c.c., 60 per cent. in three hours. There were eight ounces of residual urine. The blood Wassermann test was negative. Blood urea (Van Slyke): 29 mg. of urea per 100 c.c. The preparation of the patient consisted of catheterization twice a day for a few days and the use of a permanent catheter for several weeks. There was considerable general decline when the catheter was first used, but the subsequent improvement was marked. The blood-pressure before treatment was 125–83. The phthalein return varied from 35 to 70 per cent. in two hours. On the eighth and eighteenth days during the preparation a chill followed by a rise in temperature occurred. A suprapubic prostatectomy was performed, the capsule being sutured and the bladder completely closed. A urethral catheter was inserted for drainage. The temperature did not run above 100, there were no complications, and the patient was dismissed with his wound entirely healed on the eighteenth day.

Examination of the blood before any preparation was made showed 70.7 per cent. polynuclears and 5400 leukocytes. At the time of the prostatectomy there were 74 per cent. polynuclears and 13,200 leukocytes. Several days after the prostatectomy there were 86.7 per cent. polynuclears and 25,600 leukocytes.

Bacteriological examination of the urine before any treatment revealed Staphylococcus albus and a large saprophytic coccus on all media. The anaërobic culture was not good. Bacteriological examination of the urine after four days of repeated catheterization showed Bacillus coli, staphylococcus, and yeast cells on a blood agar culture. Bacillus coli and staphylococcus were present on glucose agar. Bouillon gave a growth of Bacillus coli. Anaërobic cultures showed Bacillus coli and staphylococcus. Cultures of the urine some time after operation showed the pneumococcus on all media.

Bacteriological examination of a glucose agar culture of material

taken from the gland at the time of prostatectomy showed the pneumococcus and Bacillus coli. Blood agar, bouillon and anaërobic culture gave growths of Bacillus coli and a Gram-positive diplococcus, probably a pneumococcus.

CASE II (A184364).—G. H. L., a farmer, sixty-one years of age. This patient was an old alcoholic and had had frequency of urination for five years. One week previous to our examination he had acute retention. The catheter was used once and since then there had been incontinence. Weight normal. Heart action slightly irregular. Hemorrhoids. Rectal examination revealed a large benign prostate. The blood-pressure after treatment was 150–88. Urinalysis: 400 c.c., specific gravity 1018, albumin, red blood cells, and white blood cells. Blood urea: 21 mg. in 100 c.c. Phthalein test: 45 to 50 per cent. returned in seven to seventeen minutes. Because of the acute retention and much pain on passing the catheter the preparation consisted in preliminary drainage of the bladder by suprapubic cystostomy. During the two weeks following this operation there was continuous improvement and at the end of that time a prostatectomy was performed. The temperature rose to 102+° soon after the operation but returned to normal in three days and remained so until the patient was discharged with his wound healed at the end of four weeks.

The blood examination made when the patient was first seen and before any treatment had been given showed 70.7 per cent. polynuclears and 15,600 leukocytes. Six days after the drainage operation there were 67.7 per cent. polynuclears and 8200 leukocytes; six days after the prostate was removed 77.3 per cent. polynuclears and 18,400 leukocytes.

Bacteriological examination of the urine before treatment revealed Staphylococcus albus in bouillon, glucose agar, and blood agar cultures. Anaërobic glucose agar culture was sterile for four days. Bacteriological examination of the urine after suprapubic drainage revealed the staphylococcus, pneumococcus, and Bacillus coli in a bouillon culture. Blood agar showed the pneumococcus and Bacillus coli. Anaërobic agar showed the

Bacillus coli and pneumococcus. Bacteriological examination of the urine eight hours after prostatectomy showed the Bacillus coli and streptococcus in glucose agar culture. Blood agar gave a growth of Bacillus coli and a diplococcus. Anaërobic culture showed the Bacillus coli. Blood agar and bouillon cultures of the urine six days after prostatectomy showed the Bacillus coli and a streptococcus. Glucose agar gave a growth of Bacillus coli and pneumococcus.

Bacteriological examination of a culture taken from the wound four days after suprapubic drainage showed a staphylococcus in bouillon. The anaërobic culture was sterile. Glucose agar and blood agar showed the Staphylococcus albus and Bacillus coli. A culture made from the wound at the time of the prostatectomy showed Bacillus coli and staphylococcus. Six days after the prostatectomy cultures from the wound showed the staphylococcus and Bacillus coli on glucose agar and in anaërobic media.

Case III (A4162).—M. D. S., banker, fifty-six years of age; married twenty-eight years; two children. This patient had had urinary difficulty for six years, gradually growing worse. For three years he had had dribbling. He had never used a catheter. The physical examination was negative except that a hard and encapsulated enlargement of the prostate was palpated per rectum. The blood-pressure was 154–98. Urinalysis: 400 c.c. in twenty-four hours; specific gravity 1021; slight amount of albumin and pus. The blood examination showed 83 per cent. hemoglobin, 9400 leukocytes. There was one ounce of residual urine. Phthalein test: 50 per cent. returned in two hours. Blood urea: 33 mg. to 100 c.c. It did not seem necessary to institute any preliminary preparation. A prostatectomy was done without the drainage operation, as the amount of residual urine was small and the other examinations were satisfactory.

Examination of the blood on the day of the operation showed 66.7 per cent. polynuclears and 8800 leukocytes. Four days after operation there were 84 per cent. polynuclears and 11,600 leukocytes.

Bacteriological examination of the urine before operation

showed a scanty growth of staphylococci on all media. The blood agar culture of the urine five days later (the patient's temperature had been 101.5° the evening before, the highest at any time during the convalescence) showed Bacillus coli, staphylococcus, and pneumococcus. A bouillon culture gave a growth of pneumococcus and staphylococcus. Glucose agar showed Bacillus coli and staphylococcus. The anaërobic culture showed Bacillus coli and pneumococcus. A culture made from the prostate soon after it was removed showed no growth.

The convalescence was uneventful and no evidence of infection was noted at any time. The wound was slow in healing, but this was evidently due to the condition in the prostatic urethra and not to the infection.

Case IV (A187926).—J. L. G., a janitor, sixty-five years of age; married thirty-four years; three children. The urinary difficulty had begun three years previously with urgency of urination and dribbling. The patient had never been catheterized. The physical examination was negative except that on palpation per rectum the prostate was found to be benign but enlarged, firm and hard. The blood-pressure was 150–115, 150–90. Urinalysis: 600 c.c. in twelve hours; specific gravity 1030; otherwise negative. The phthalein returned in fifteen minutes, 60 per cent. in two hours. There were two and one-half ounces of residual urine. Blood urea: 37 mg. in 100 c.c. Examination of the blood showed 54 per cent. polynuclears and 4800 leukocytes. As the patient's general condition was good, the amount of residual urine small, and the specific gravity and renal function normal, it was not considered necessary to institute preliminary treatment, and suprapubic prostatectomy was performed.

Examination of the blood on the day of the operation showed 86 per cent. polynuclears and 10,600 leukocytes. Four days after the operation there were 80 per cent. polynuclears and 10,500 leukocytes.

Bacteriological examination of the urine before any catheterization and before the operation showed staphylococci in all cultures. Anaërobic and aërobic cultures in bouillon and glu-

cose agar were sterile. Blood agar showed no hemolyzing streptococci. Four days after the operation a glucose agar culture of the urine showed Bacillus coli and pneumococcus. Blood agar also gave a growth of Bacillus coli and pneumococcus. Anaërobic and aërobic culture in bouillon showed Bacillus coli and pneumococcus.

Four days after the operation a culture from the wound showed Staphylococcus albus.

There was no rise in temperature or suggestion of infection at any time during the convalescence (the temperature was never more than a fraction above 99°), but on the sixth day a considerable number of colon bacilli and cocci were found in the urine. The wound healed in a little more than three weeks.

Case V (A150733).—J. M. P., a laborer on the road, sixty-five years of age; married forty-four years; four children. The urinary difficulty consisted in smarting on urination for the previous three years. Examination per rectum revealed a median enlargement of the prostate. The blood-pressure was 128–86, 135–95. Urinalysis: 750 c.c. in twelve hours; specific gravity 1028; otherwise negative. There were two to three ounces of residual urine. Phthalein test: A showing in ten minutes, 35 per cent. in two hours; second test, a showing in fifty minutes, 50 per cent. in two hours. Blood urea: 30 mg. in 100 c.c. and 42 mg. in 100 c.c. In spite of the good renal function it seemed best to make a suprapubic drainage before removing the prostate, as the patient was not in a good general condition. No reaction followed the drainage of the bladder, and about three weeks later a suprapubic prostatectomy was performed. The temperature was 100° on the second and third days following the operation but was not above normal at any other time during the convalescence, and the patient was discharged on the nineteenth day with his wound healed.

Examination of the blood at the time the operation for drainage was performed showed 85.3 per cent. polynuclears and 22,400 leukocytes. Five days later there were 80.3 per cent. polynuclears and 13,000 leukocytes. At the time of the prostatec-

tomy there were 61.7 per cent. polynuclears and 18,000 leukocytes.

Bacteriological examination of the urine at the time of the operation for drainage of the bladder showed pneumococcus on the blood agar culture, but there was no growth on the other media. Before any treatment had been instituted glucose agar, bouillon, and anaërobic cultures were all sterile for four days. Four days after drainage of the bladder, an agar culture showed staphylococcus, streptococcus, and Bacillus coli. A staphylococcus, Gram-negative saprophytic organism was found on anaërobic culture. Bouillon culture showed streptococcus and staphylococcus and a Gram-negative bacillus. At the time of the prostatectomy, glucose agar, blood agar, anaërobic cultures and bouillon showed Bacillus coli and pneumococcus. Glucose agar, blood agar, bouillon and anaërobic cultures of the urine four days after prostatectomy showed pneumococcus and Bacillus coli.

A glucose agar culture of material taken from the wound four days after the prostatectomy showed large Gram-negative saprophytic bacilli, probably saprophytes.

In spite of the fact that many organisms were present in these cultures, the patient showed no evidence of infection at any time and made a prompt recovery.

DISCUSSION

Dr. Howard Lilienthal, New York City:

It appears to me that the presence of a catheter for a long time in the urethra of a man who has been suffering from prostatic retention is a disadvantage. It does not give the same relief that is afforded by a suprapubic cystostomy, and even though it does do away with the back pressure upon the kidneys, the presence of a catheter in the deep urethra is a frequent cause of septic absorption. I do not believe that the indwelling catheter takes the place of the first stage of prostatectomy. Another point: I believe that one reason that very ill patients make such good recoveries while those who are operated upon during the quiescent stage may suffer from septic complications is that when the patient is already septic, whatever is done to relieve his condition is also the first step in the relief of sepsis, and this improvement goes steadily on toward complete convalescence; while if we take a patient who is not septic at the time of operation his condition is apt to deteriorate at first, finally reaching the point where convalescence begins. The principle when expressed in unscientific language would be that when we operate upon a very ill patient he is at once made better, while when we operate upon a "well" patient he has to become ill before he begins to improve.

OBSERVATIONS UPON SHOCK, WITH PARTICULAR REFERENCE TO THE CONDITION AS SEEN IN WAR SURGERY

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During the past two years I (E. A.) had the good fortune to spend eighteen months in service in France, four months of which were spent in a hospital close to the front.

There are three kinds of service in the surgery of the present war: (1) that of the hospitals close behind the front line, called by us casualty clearing stations; (2) that of the base hospitals in France, which are usually situated from thirty to sixty miles back; (3) that of the base hospitals in England. In England one sees chronic surgery; at base in France one sees subacute and acute infections, and one goes continually shrapnel-hunting.

But in the casualty clearing stations one sees three conditions in particular which are rarely or never seen at base far back. They are abdominal wounds, the early and severe effects of "gassing," and finally shock; and shock is seen to an extent unparalleled in the experience of any surgeon at home. The very frequency of it, and the terrible nature of it, were impressive, and not less so, our inability to rescue such patients when the degree of shock was really serious.

In what is here said today we do not pretend to bring forward anything particularly new, but we thought that a general review

of these cases of shock from the clinical side, with notes upon such methods of treatment as we were able to carry out, might be, particularly at this time, of interest to the members of the Association. In addition, we would like to refer, very briefly, to the prevailing theories concerning shock and to offer in the light of our clinical experience a few suggestions concerning these theories.

In order to get a better comprehension of the conditions under which we did our work, let us relate, very shortly, the manner of evacuation of the wounded from the trenches to our casualty clearing station, situated some six to eight miles behind the front-line trenches. The wounded soldier is usually carried without delay by the battalion stretcher bearers down a communicating trench to the dug-out of the battalion medical officer situated 400 or 500 yards back. Here first aid is given, and then, if possible, the man is carried, still by stretcher bearers, for another 400 or 500 yards back to a point where a horse ambulance is waiting. This can, of course, usually be done only at night, and there is sometimes a long delay while waiting for darkness. The horse ambulance works back another mile or so to a point where it is safe for motor ambulances to wait. Here another transfer takes place. The motor ambulance then brings its load to field ambulance headquarters, or, if the wounds are serious, straight to the casualty clearing station, situated anywhere from five to ten miles behind the trenches, and usually at what is called rail-head. Here the wounded man finds his first good resting-place. The casualty clearing station has on its establishment accommodation for 250 stretchers, which is expansible up to 500 or more. During the past year and a half a limited number of proper hospital beds, from thirty to fifty, have also been provided by the army for the more serious cases, while the less serious ones are cleared the next day, or even the same day, by ambulance train down to base. It thus happened that we had under our care at any one time some 20 to 40 really bad cases. These were chiefly wounds of the brain, of the lung, and of the abdomen, together with bad compound fractures and multiple

soft part wounds. Among all these, as you can imagine, shock was frequent.

Now, we would call your attention particularly to the fact which is not always appreciated, that the transport of the wounded from the trench to the casualty clearing station is frequently a most trying experience. The soldier, before he is hit, is often in a state of fatigue, and not seldom during the winter is he wet and cold into the bargain. Add to this the jolting of a stretcher journey of 1000 yards down a muddy, slippery, uneven communication trench; add to this the bumping of a horse ambulance along the roads of France, such as they are at present, well up toward the lines; add to this the transfer to the motor ambulance and a vibratory ride along the stone pavés of that country; add to this a couple of changes of dressing of a painful wound; add a certain loss of blood even in the best cases; add finally the effect of cold and you get a composite set of circumstances for the reduction of the patient's resistance than which even Dr. Crile could ask nothing better. The wonder to us was that we did not have more shock than we did. We may dismiss this aspect of the question by saying that an investigation of the cases showed quite clearly that a great many of the sufferers from shock gave a history of great exposure to cold and to fatigue during the time which elapsed from the receipt of their injury to their arrival in hospital. The influence of these factors was quite unmistakable. A French surgeon, M. Santy, in a very recent number of the *Lyon Chirurgical*, has called particular attention to this fact, and he was able to fill in a lacuna in our own experience. He had served both in the advanced dressing station and in what corresponds in their army to the casualty clearing station, and he says that, apart from those who die on the field, the occurrence of shock in the wounded soldier when seen soon after infliction of his wound is extremely rare, but that the loss of even a strictly moderate amount of blood, together with the distresses of transport, will frequently push a wounded man, previously in good condition, into what he calls secondary shock, before his arrival at the hospital. [From what has been related to me by my friends

serving with battalions and with advanced field ambulances I am quite sure that M. Santy is right. There is a tale told me, for instance, by a friend of mine of a man whom he saw wounded in the abdomen, actually running down the communication trench to seek help, with the bulk of his small intestine hanging out in front of him. That man was not, at first, in shock. E. A.]

One need spend but little time on the definition of shock. Although the physiologists have for years past been trying to define shock for us, we clinicians are fairly well agreed upon the matter. The picture was a sharp clinical one before physiology was. The low-tension pulse, usually rapid, sometimes not, the shallow breathing, the pallor, sometimes going on into a light cyanosis, the lack of apparent suffering, the carelessness as to one's surroundings, the preservation of a clear though lethargic mind up to the very last—these things are all familiar to us, and these were the symptoms which, in our experience, were constantly present, whether the injury concerned the bones and soft parts or the abdomen. Let us remark in passing that wounds of the chest and of the head very rarely, indeed, presented the symptoms of shock. In going over the notes of our shock cases we find that practically all were wounds of the locomotor system or of the abdomen. Of these we have for consideration 44 cases, of which there were 32 abdominal, 10 multiple wounds of the extremities, with or without compound fractures, and 2 chest cases. We tried to keep decent records of our bad cases, particularly with regard to blood-pressure, but you will understand that these notes were not infrequently somewhat fragmentary on account of the press of work. From the review of these observations we have picked out a few main facts meriting discussion.

The very serious influence of fatigue, cold, and exposure as aids in the production of shock has already been referred to.

Out of 25 cases, moderate and severe, in which reference is made to this point, there were only 2 in which the patient was said not to have suffered from it. Roughly speaking, the degree of fatigue and exposure ran parallel with other serious symptoms

of shock, although not always corresponding with fall in blood-pressure. In practically all the recovery cases it is mentioned that while there was some fatigue the patients were warm.

Temperature. Guy Kinnaman, in an article some years ago, pointed out the serious effects of shock upon the temperature. He found uniformly a serious fall. His work was done on animals. We have found in these clinical cases, and also in a small series of experiments (E. A.), a confirmation of his general results. Very frequently, if the patients were in marked shock, the clinical thermometer would not register, which meant that the temperature was somewhere below 92°. Of 12 cases in which the temperature was low to this extent, death within a few hours took place in 9. There were only 3 recoveries, and of these, 2 died later of gas gangrene.

Pulse and Blood-pressure. If shock were marked, as judged by the general signs, blood-pressure was practically always below 75, and occasionally it could not be got at all. Out of 17 cases with a blood-pressure below 75 only 3 rallied from shock, and these all died in two or three days from gas gangrene. All the rest died within a few hours after admission or after operation. The pulse was nearly always rapid, that is, 110 or over. This probably has the same significance as in hemorrhage—a lack of sufficient blood to the ventricle in diastole. Respiration was usually increased by six to twelve in a minute, *i. e.*, 24 to 32, and was always shallow.

Hemorrhage. Hemorrhage, of course, was apt to complicate the picture. It is well known that even a moderate loss of blood tends to predispose to or aggravate shock. However, there was a considerable number of cases in which hemorrhage was either absent or very slight. In these apathy and cyanosis as opposed to restlessness and blanching were marked. Another striking difference lay in the effect of intravenous salt or of transfusion—helpful in hemorrhage, useless in severe shock.

It was frequently necessary, on account of infection or bleeding, or, in abdominal cases, the presumed danger of peritonitis, to operate soon after admission in the middle of shock. It can

easily be imagined how serious such operations were. In a general way, operations aggravated shock very definitely. The old dictum that one should wait for the rally seemed to me to be absolutely confirmed by our experience.

TREATMENT. Treatment under the conditions in which we worked was frequently difficult to carry out thoroughly. We were often short-handed for the extreme demands which such cases made upon one's service. However, we did manage to give a great deal of salt solution; we learned to prefer to give it intravenously rather than under the breast; in the latter case it was apt to be absorbed far too slowly to do any good. Rectal salines were often given in addition. Our experience confirmed what we all know, that the effect of intravenous salt is very transitory. It rarely held up the blood-pressure in serious cases more than a couple of hours, often much less. If, however, the trouble were chiefly hemorrhage, results were very much better. A number of cases with a blood-pressure of around 70 or over, were saved by intravenous saline. In a certain number we gave, following Hogan, a colloid solution of 25 grams gelatin in a liter of saline. Its effect lasted three or four times as long; nevertheless, in cases of bad shock it did not avert the fatal outcome; in hemorrhage it was more effectual than the saline alone.

Transfusion of blood was done in 3 cases, using the citrate method, 16 to 20 ounces being given. Its effect was disappointing; while the color was improved and a slight rise of blood-pressure was got, it had no more permanent effect than the gelatin or salt. In this the contrast with its truly life-saving action in cases of pure hemorrhage was most striking. After all, in shock we are not dealing with lack of blood alone but with some complex mechanism by which blood is continuously withdrawn from the circulation; and to transfuse simply means that your transfused blood gets lost with the rest.

The head-low position was, of course, always used, but without obvious influence save in light cases. Pituitrin was freely employed, and always brought up the pulse to a certain extent; but this was often transitory, and, on the whole, we concluded that

it had no real beneficial effect in bad shock. In moderate shock it was of distinct value. Theoretically it ought to do good. The constriction of the peripheral arterioles now proved to be present in shock is very possibly a protective measure to compensate for lack of blood volume. It is, perhaps, indicated to increase this if possible, but adrenalin is contra-indicated because of its constricting action on liver capillaries, and we cannot afford to have an engorged liver obstructing free return from the splanchnic area; besides, adrenalin is altogether too transitory.

In 2 cases we tried the opposite line of treatment, giving amyl nitrite in order to dilate the tight arteries of the periphery. There was a very fleeting improvement in the color of the skin, but no delay in the fatal exit. In another case we tried alternate rhythmic compression of the abdomen for an hour, but this had no good effect. In another case we rigged up a see-saw arrangement and kept up alternate head-low and horizontal positions for some time. We concluded that the permanently head-low position was better. Hot-water bottles were freely used of course. The majority died in spite of all our efforts.

The Interpretation of Blood-pressure Readings. We used the auscultation method with the Tycos instrument.

Systolic blood-pressure is not so important in advanced shock as diastolic. Systolic may occasionally be up near 100 and diastolic be low, 20 to 40. This spells shock.

If an intravenous saline raises a low systolic but fails to raise the diastolic, shock is still present and unrelieved, and the patient will die. (This I have also seen in animals during the terminal stages E. A.) The systolic peak under such circumstances does not mean much.

If the sharp click of the systolic is weak or distant throughout, there is danger.

If the systolic sound is first heard only during expiration, and becomes continuous only some ten to twenty millimeters lower, such cases are always in shock and blood-pressure is low. They frequently die.

A man with the clinical symptoms of shock, whose systolic

blood-pressure is 65 or below, rarely recovers. One whose blood-pressure is low from hemorrhage alone will frequently recover. Salt solution does no permanent good in the first but does good in the second.

Ordinary hemorrhage, unaccompanied by fatigue or cold, does not reduce pressure materially. A very large amount of blood must be lost to lower it to 75. Frequently we would find the abdomen full of blood, by measurement 45 to 55 ounces, and blood-pressure would be normal if shock were absent.

THE CAUSE OF SHOCK.[1] Space fails me to resume all the work that has recently been done. I must content myself with making categorical statements. Assuming that shock is due to circulatory failure we have to ask ourselves two questions: (1) at what point of the circulation is the failure primary? (2) what is the cause of the failure at that point?

Let us briefly consider all the systems concerned:

1. The heart is strong enough.
2. The vasomotor center is strong enough.
3. The arterial tree is strong enough.
4. The peripheral capillaries are empty (blanched) or contain half-stagnating blood (cyanosed).
5. The peripheral veins show low blood-pressure and are comparatively empty, as shown by the difficulty in finding veins in the arm for infusion, and in animals by direct observation (*e. g.*, the smallness of femoral vein in experiment of May 14, 1917, when exposed for injection of gum solution).
6. The splanchnic veins are sometimes moderately full, sometimes not. This is particularly true of animals in which marked engorgement of this area is not present unless shock has been produced by manipulation of the viscera.
7. The tissues of the dog's intestine become markedly edematous when shock is produced by manipulation of the bowel, also, though to a less extent, when produced by mere exposure of the bowel.

[1] The rest of the paper by E. A.

8. The lungs do not give out, though they contribute by shallow inspiration and prolonged expiration, with consequent lack of suction, to the diminution in the return of venous blood to the heart.

9. The brain is clear to the end.

10. The muscular system is relaxed and contributes by lack of work to stagnation of venous blood.

11. The adrenals, according to Bedford, are not exhausted, but, on the contrary, deliver an increased amount of secretion during profound shock right to the end.

Now as to blood-pressure. While a low blood-pressure is one of the most constant signs of shock it is not the essential thing, let alone the cause of it. We have focussed our attention far too much on blood-pressure, so much so as unconsciously to have come to regard it as being almost causal.

To raise peripheral blood-pressure accomplishes nothing save a mechanical effect. A raised blood-pressure is not life. In bad shock the saline runs into the tissues from the blood and you are left as poor as before. Even blood, let alone Hogan's gelatin solution or Bayliss's gum-acacia solution, will do but little more; it, too, disappears into the tissues. Dolley kept up blood-pressure in shocked dogs to near normal for two or three hours by repeated transfusions of blood; but at the end of that time blood-pressure fell rapidly, and then the dogs died of shock in ten minutes. The fundamental trouble was not removed. Janeway and Ewing bled two dogs into one shocked dog. The latter accommodated all this blood and continued in shock while the two donors were left exsanguinated.

What the nature of the cause of this loss of fluid from blood to tissues is can as yet only be guessed. I do not believe it is hyperpnea from *pain* and consequent general acapnia as Henderson suggests. Our patients all received $\frac{1}{2}$ grain of morphin at the Field Ambulance, and it did not prevent shock. It may be a local acapnia when bowel is long exposed, but primarily it is more probably in the nature of an inhibition by which capillary tone is lost and the balance of the local chemical changes between

blood and tissue or cell fluids is upset; perhaps chemically, perhaps by stagnation and insufficient oxidation. I imagine cold, fatigue, and wet may assist such an upset. Death by freezing, for instance, is one form of shock, and shock may be brought on in animals by cooling the blood, as Mann showed. But on top of that comes severe local injury, loss of blood, wounds of the mesentery—all combined may let loose reflex inhibition.

Recent English work has demonstrated in shock a serious loss of plasma into the tissues with consequent rise in the hemoglobin count and the viscosity of the blood in the vessels. In shock produced by histamin, Dale and Laidlaw showed that one-half the plasma had disappeared into the tissues. The same is true in cholera shock. Captain Marshall (personal communication) has found an increase of 20 per cent. in the hemoglobin count in shock cases at a Casualty Clearing Station. On the other hand, obvious edema at postmortem is not always or even often seen unless large amounts of saline have been infused. I suspect it may be in traumatic shock what Krehl suggested was the case in fever, that the extra water is retained chiefly in the cells themselves and not in the tissue spaces.

By exclusion, therefore, it appears to me that the trouble begins in the vast capillary system, that enormous area of marshy ground in which fluid has such a chance to stagnate. We know, with fair certainty, now, from the work of Cotton, Slack and Lewis, that the capillaries possess active contractility. Dale and Laidlaw believe that in shock produced by histamin the tone of the capillaries is lost and blood stagnates. For the present I accept this as the point of primary failure in traumatic shock. Pallor, followed in bad cases by cyanosis, is an outstanding feature in our observations. The veins no longer receive enough blood. If they did we could overcome shock by gravity and by compression, which we usually fail to do. Consequently the failure in the venopressor mechanism (Y. Henderson) is a secondary effect; likewise the gradual failure of the heart and of the coronary supply, all of which assist in the establishment of a vicious circle. The capillary failure leads to

insufficient oxidation, which results in asphyxial acidosis. "The acid substances thus formed cause the proteins of the tissues to imbibe water from the blood in much the same manner that fibrin swells in dilute acids. Hence the fatally rapid transudation of fluid from the bloodvessels." (Henderson.)

This work suggests that hypertonic salt solution at twice decinormal strength would be of some promise. Its chief effect would naturally be to call back into the blood the plasma lost to the tissues. But very possibly it also acts by restoring capillary tone. I am told that some encouraging results have recently been obtained at the front with it. I have no clinical experience, but in one of my animals, reduced to deep shock by abdominal exposure, the tongue, up to then quite cyanosed, recovered very quickly with hypertonic salt a normal pinkish tinge, obviously a local effect on capillaries, inasmuch as blood-pressure previously at 35 was raised only to 50.

INJECTION OF THE GASSERIAN GANGLION FOR NEURALGIA OF THE FIFTH CRANIAL NERVE

By GEORGE TULLY VAUGHAN, M.D.
WASHINGTON, D. C.

Cutting with or without resection of the affected nerves for neuralgia is a comparatively old method of treatment, as it was used by Astley Cooper, Velpeau and the elder Warren, but the method by injection of destructive substances into the nerve seems seldom to have been used previous to 1884, when Neuberg reported cases treated by injections of osmic acid.

It seems that Wright, in 1907, was the first to inject the Gasserian ganglion, exposing the ganglion as if for removal and then injecting it with osmic acid, and later Rasoumowsky used alcohol in the same manner.

Schlösser, Sicard, Ostwald, Härtel, Wright, Harris and Camp by degrees worked out the methods now used for injecting the ganglion through the foramen ovale from the skin.

According to Byrnes, Ostwald and Sicard, in 1906, suggested the subcutaneous way of injecting the ganglion. Pussep, in 1911, made the first though unsuccessful attempt by this method —at any rate he was so unfavorably impressed by the immediate effects on the patient—vomiting, headache, slow pulse, and cyanosis—that he condemned the operation as unjustifiable. Four months later Taptas, of Constantinople, seems to have made accidentally the first successful injection into the ganglion while trying to inject the third branch. Wilfred Harris, of England, working along the same lines and about the same time, improved the technic by inserting the needle through the

lower part of the sigmoid notch, and in 1912 published 7 cases. The operation is not very difficult; it is pretty sure to give relief for a time, perhaps permanently, and should be tried in all cases before doing a gasserectomy.

There may be some question as to whether or not it should be preferred to the Frazier-Spiller operation, as the latter operation preserves the motor functions of the nerve. Experience shows that injection is the safest operation—certainly as to life and probably also as to the bad effects produced on the eye.

Weidler says that in a series of over 300 cases of alcohol injections, in only one was there serious keratitis, whereas in 70 cases of gasserectomy a number of cases of keratitis occurred, and in 4 cases enucleation of the eye was necessary. This may not be a fair comparison, as in few of these injections was the ganglion attacked. However, no surgeon would agree with the statement that injection of the ganglion is free from danger, and yet I know of only one death reported from it—that of Härtel—from septic meningitis, probably due to an error of technic. The danger of injuring some of the important structures that are so intimately related to the ganglion, either by needle puncture or by the action of the alcohol when one is feeling his way in the dark, is certainly great, but experience shows that if such injuries are inflicted, they do not seriously affect the patient. The structures which are most liable to injury are the internal maxillary and middle meningeal vessels, the cavernous sinus, the third, fourth, and sixth nerves, the carotid artery, and the under surface of the temporal lobe of the brain. The injury may be purely mechanical from punctures, laceration, or contusions, or it may be chemical from the action of the alcohol on the tissues, or it may even be the result of infection.

My cases are reported chiefly because it is only by observing the results in large numbers that we can reach a reliable conclusion as to the value of any remedy.

Patient 1. Three injections. Woman, aged forty years, with history of tic douloureux for fifteen years on right side and a slightly shorter time on the left side. All three branches affected

on both sides, but especially the second. Ten years before, Dr. Finney had removed the right infra-orbital nerve with only partial temporary relief. She is an intelligent, educated woman and knew something about the surgical treatment of her trouble, and came to me for the purpose of having both Gasserian ganglions removed—her suffering was so great. She was persuaded to try the method by injection first. With the patient in a half-reclining position under local anesthesia, with a cork between the teeth in order to lower the sigmoid notch about half an inch, the graduated needle with blunt point was inserted on a line drawn from the lower part of the mastoid process to the lower part of the malar bone and carried inward through the lower part of the sigmoid notch slightly backward and slightly upward until the point entered the foramen ovale, indicated by the limitation in the lateral motions of the point, by the depth, 4.5 cm., and in this case by the escape of a few drops of cerebrospinal fluid. The needle was pushed a little farther until the total distance from the skin was 5 cm. The syringe was attached and 1 c.c. of novocain with adrenalin was injected. In five minutes there was no conjunctival reflex on that side and 1 c.c. of alcohol was then injected and the needle was withdrawn.

The same procedure was then carried out on the other side. In fifteen minutes there was anesthesia of the entire face.

Next day there was a return of pain on the right side in the region of distribution of the first and second branches, and as this continued, another injection of the right ganglion was made one week after the first—exactly the same technic. This time there was wide dilatation of the right pupil which lasted two or three days. Complete relief followed this injection. Patient was cautioned to take care of the eyes on account of the danger of irritation from the lack of normal protective sensation.

Examined more than a year later the conjunctivæ were a little congested in both eyes; there was no trouble with the cornea. There was analgesia of the entire face, though pressure could be felt. Patient had had no pain and expressed herself as well pleased with the result.

Patient 2. One injection. Woman, aged thirty-four years, highly nervous—had suffered with severe pain in the right eye, ear, temporal region, and side of the face. Has taken large doses of morphin for the pain. No disease of eye, ear, or brain could be detected.

Right ganglion was injected. Temporary ptosis of upper lid and dilatation of the pupil followed, and there was analgesia of that side of the face, but the patient still complained of pain but less in degree. The pain soon passed off, but some ptosis and dilatation of the pupil remained when she was last heard from, about three months after the operation.

Patient 3. Man, aged fifty-six years, with right-sided neuralgia of fifth nerve, for which the infra-orbital had been removed ten years ago, giving relief to the middle of his face; but he continued to suffer in regions supplied by the first and third branches, and came to me for removal of the ganglion. It was decided to try injection of the ganglion first. An attempt was made in the usual way, but failed to enter the foramen ovale, and only the third branch was anesthetized. Five days later the attempt was again made, entering the needle 0.5 cm. lower than before, when it was guided into the foramen with little trouble, the total depth being 6 cm. from the skin. One c.c. of 95 per cent. alcohol was injected. This gave complete relief, but it is yet too early to predict anything as to its permanence.

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DISCUSSION.

Dr. Samuel J. Mixter, Boston:

I wish to say a word about these alcohol injections of the Gasserian ganglion. I have never tried the operation; in fact, I never tried to inject the trifacial nerve. My son, Dr. W. J. Mixter, injects these nerves for me, but we have not tried injecting the ganglion, and I do not intend to do so in spite of Dr. Vaughan's paper. In the first place it is working a good deal in the dark; in the next place, the operation of exposing the ganglion is so easy I would rather do that than take the chances with a needle. Again, I do not think it necessary to get rid of the whole ganglion even in cases in which there is pain in the first division at the time of operation. I should think that Dr. Vaughan would have been very glad that he did not get anesthesia of the eye when he injected the ganglion in one case. In other words, he got the second and third divisions and not the first, which was an advantage. The pain in the first division practically always goes away when you get rid of the trouble in the second and third. I have injected the ganglion with osmic acid and also with alcohol after the ganglion has been exposed, but I injected the stump of the second and third nerves and I never had trouble with the first divisions in these cases. I can say that in cases in which I have left the ganglion, using the modified Abbe, I have never lost an eye.

Dr. Emmet Rixford, San Francisco:

I would like to ask the effect of the alcohol in the unusual case of bilateral ganglionic paralysis; whether there was motor disturbance on the right side?

Dr. George Tully Vaughan, Washington, D. C. (in closing):

As far as I could see there was no difference in the case to which Dr. Rixford referred. I think there are a good many things about the Gasserian ganglion and branches of the fifth nerve that we do not understand. On one patient I did a Frazier-Spiller operation. I had a good exposure of the ganglion and nerve roots and divided the larger and pulled it out with forceps, leaving the motor root there. One would expect complete anesthesia after that. The patient still suffers as much as she did before.

I cannot help but think, although I have a very high respect for Dr. Mixter's opinion, that the operation of gasserectomy has a higher mortality than the method I advocate. If the ganglion remains they are apt to have the pain recur.

PROSTATECTOMY

By JOHN B. DEAVER, M.D.
PHILADELPHIA

The selection of cases for prostatectomy is far more important than is the method of approach. The unavoidable complications of the operation including pneumonia, pulmonary embolism, acute dilatation of the heart, and cerebral embolism should exceed in number the common causes of death, of which the most frequent are uremia, hemorrhage, sepsis, acute renal infections, and apoplexy. The incidence of pulmonary congestions and infections will probably remain unchanged, although some benefit may be expected to follow careful regulation of the hygienic regimen and judicious selection of the anesthetic. The decision for or against prostatectomy in cases in which the probabilities of prolonged comfort with catheter life are great may depend upon the presence or absence of emphysema, bronchiectasis, chronic bronchitis, or tuberculosis. Pulmonary complications of such gravity as the aforementioned are clear contra-indications to operation, providing the patient can find reasonable comfort in non-operative measures.

Obstructions of the lower urinary tract give rise to early destructive changes in the kidneys through alterations in the mechanics of urinary excretion. The renal changes, serious in themselves, give rise secondarily to cardiovascular and metabolic disorders, and the resultant invalidism renders the subjects of the associated pathology hazardous risks in major surgery. In addition to these chronic and, to a certain extent, irremediable changes in the cardiovascular and renal systems the almost

invariable presence of urinary infection adds another source of potential danger to the surgery of prostatic obstruction. At least 75 per cent. of the patients who present themselves for prostatectomy have infected bladders, and in a considerable number the infection has invaded the upper urinary tract as well.

Infection in these cases is often beneficent in that its prolonged residence in the urinary tract has created a certain immunity on the part of the tissue, thus minimizing the danger of severe postoperative inflammation. In other instances the infection has already become widespread and has added its influence to back pressure in renal destruction. In a third group of cases the inflammation, although localized to the lower urinary tract, has been so severe in its manifestation and has given rise to so much discomfort that the vitality of the patients is almost exhausted when they come to the surgeon. The average case presents not only a combination of the foregoing processes which may be said to depend upon the urinary obstruction, but in addition his vital organs show the scars of the battle of a life almost spent. The degree of myocardial degeneration, arteriosclerosis, and of chronic nephritis dependent upon ancient inflammations and entirely independent of the obstruction at the vesical outlet must be sought for and their probable influence in functional crippling ascertained.

The prostatic is therefore primarily a complex problem for functional study, a problem whose solution is the determination of the maximum reserve power of his vital organs. Ordinarily these patients have already drawn heavily upon their reserve function before operation is considered. Furthermore, it is safe to assume that there will be no further utilization of reserve power during the preoperative interval spent in the hospital. It is likewise fair to assume that the prostatic has reached the lowest ebb of vital function that he will experience, barring, of course, the cases that are moribund when they are sent for hospital treatment. It is therefore the duty of the surgeon to ascertain by various tests and examinations the level of descent

of vital activities representative of the lowest "ebb" of function, and to so treat the patient that the highest "flow" of function will be attained and maintained before attempting enucleation of the prostate. In no instance, however physically fit the individual may seem to be, is operation justifiable until these studies have been completed.

Before taking up the question of surgical treatment of the different classes into which these cases group themselves we will consider briefly the means at our disposal for determining the vital reserve powers and the therapeutic measures useful to increase them.

The individual who passes a normal quantity of normal urine that is physically and chemically normal is possessed in the majority of instances of kidneys that are surgically sound. Unfortunately this is rarely seen in patients with prostatic enlargement. The chemical composition of the urine of these patients, while important as an index of renal function, lacks the ease of determination and the accuracy of the phenolsulphonephthalein test. As an index to the capacity of the kidneys to excrete solids we have in this drug a means that is extremely simple in its application and among the most accurate of laboratory tests in general. A wealth of clinical experience confirms the original findings of Rowntree and Geraghty,[1] and the phthalein test is, at this time, one of the important means of determining the degree of renal function. We have learned to depend upon the urea nitrogen content of the blood as indicative of the renal activities. This test, while of great value and of the same significance as the phthalein test, is less applicable than the latter as a routine measure. The result of either test may be compared with that of the other, thus minimizing the danger of misinterpretation. The indigo-carmine test is used frequently and always in connection with the two foregoing when there is any doubt.

The first estimation of renal function is made soon after the

[1] Jour. Pharm. and Exper. Therap., July, 1910, i, 579.

patient's admission to the hospital, and if possible at the time of the first catheterization, when the amount of residual urine is also determined. If the appearance time of the drug is delayed (over fifteen minutes) and the total output is diminished (50 per cent. or less) preliminary treatment suitable to the case is instituted. This will depend primarily upon the amount of residual urine present and the degree and activity of an existing infection. Cases with large amounts of residual urine, especially those who have never been instrumented, are poor surgical risks when operated upon immediately after the initial instrumentation. With the relief of back pressure on the kidneys incident to the sudden decrease of intravesical pressure a marked renal congestion occurs that, with the added irritation of an anesthetic, may send these apparently favorable cases into uremia.

Cystoscopic examinations are a source of great danger in impending uremia. They should be performed only after it has been ascertained that a state of relative renal efficiency exists.

In no instance should prostatectomy be attempted after a cystoscopic examination until the influence of this seemingly benign procedure on the kidneys has been determined.

It is our practice, as mentioned above, to contrast the results of the phthalein test with the urea nitrogen content of the blood. The elimination of the latter is a specific renal function and abnormal retention of urea (over 0.35 per 1000 c.c. of blood, Tileston and Comfort) has the same significance as a low output of phthalein. These two tests have proved themselves in our experience of almost equal value. In cases with advanced secondary symptoms, including anemia and loss of weight and strength, the determination of the alkaline reserve of the blood plasma (acidosis), as indicated by the hydrogen on concentration of the blood and the carbon dioxide content of the alveolar air, is made. Marked degrees of acidosis precede the onset of uremia, but aside from this the convalescence after prostatectomy is invariably uncertain when marked retention of acid salts exists.

Having demonstrated a low state of renal function it becomes

necessary to ascertain its cause or causes. The relief of back pressure on the kidneys following the institution of catheter treatment generally results in increased kidney function. An increased output of phthalein is noted, and this improvement progresses to a point where the percentage output of the drug becomes stationary. If this maximum of elimination is well beyond the low normal level the subject is generally a good one for prostatectomy. If, on the other hand, the output of the drug increases under appropriate treatment to a certain extent, but the improvement stops at a subnormal level and persistently remains there, further cause for the renal defect than back pressure must be sought for.

Antecedent chronic nephritis independent of the effect of low urinary obstruction sometimes is an important consideration. This is determinable only by exclusion. Frequently the renal inefficiency is dependent upon the cardiorenal lesion, with the cardiac factor predominating. The latter may be of valvular origin, but is more often due to chronic myocardial degeneration. Cardiac decompensation, dependent upon weakening changes in the musculature of the heart, is a serious complication that offers little or no hope of complete restoration; with few exceptions, however, these patients may be improved to the extent that prostatectomy may be safely attempted. Prolonged medical treatment is necessary and the best index of improvement is the gradual decompression of the kidneys as measured by the phthalein output.

High arterial tension becomes a complicating factor in the minority of cases. This generally improves coincidently with increased renal elimination, but in certain instances a persistent high blood-pressure calls for specific treatment. Free catharsis suffices in the mild cases; rarely is drug therapy, designed to lower the pressure, permissible. In preuremic states blood-letting, with transfusion, hypodermoclysis, or saline by the bowel, will bring immediate results in the majority of instances. Diuretic drugs, including spartein sulphate, caffein, and potassium citrate, are probably harmless and may be of some value.

In cases of acidosis, sodium bicarbonate should be administered by mouth until the urine becomes alkaline in reaction. Severe degrees of the condition call for infusion of sodium bicarbonate solution. The administration of glucose solutions by proctoclysis is a valuable adjunct in profound states of acidosis.

It is evident from the foregoing brief account that we have lately acquired valuable means of determining the operability, the temporary inoperability, and the permanent inoperability of vesical obstruction. The tests are of greatest value as indices of the improvement expected to follow preoperative treatment.

Experience has taught us that prostatics fall into more or less clearly defined groups, depending upon the local condition of the lower urinary tract and upon the degree of renal and cardiac defects. In addition we have learned that certain specific forms of treatment before operation are indicated to bring each group to the point of maximum resistance.

Group I may be made to include those cases of early prostatic hypertrophy that present few subjective signs, in which the bladder capacity is approximately normal with small amounts (less than 150 c.c.) of infected or non-infected residual urine, a normal phthalein output, and no serious organic defects in the heart or bloodvessels. Cases of this kind may be operated upon when the patients have become acclimated to their hospital surroundings, when the various tests have been carried out, and after a cystoscopic examination has been made without deleterious after-effects.

Group II includes cases in a later stage of prostatism with or without marked secondary systemic symptoms. Patients in this class are subjectively ill. The prominent symptoms are frequency of urination, dysuria and hematuria. Examination shows the presence of large amounts of residual urine which may or may not be infected. The bladder walls are atonic and diminution in kidney function dependent almost entirely upon back pressure is disclosed. Patients belonging to this group are often fair surgical risks at the outset and will become excellent risks with the institution of proper preoperative treatment.

The latter is designed primarily to relieve back pressure; to bring about renal decompression. The question now arises, Shall we attempt the relief of the kidneys by intermittent or permanent catheterization or shall we drain the bladder suprapubically, thus dividing prostatectomy into a two-stage operation. It is our practice in dealing with the mild cases in which the amount of residual urine is small to first try intermittent catheterization with sufficient frequency to keep the bladder empty. If under this form of treatment the phthalein output rapidly increases, no further preliminary treatment designed to relieve back pressure is considered necessary. The permanent catheter, which formerly held such a prominent place in our preoperative treatment of prostatics, has been practically abandoned. Its use is reserved for cases of such severity that the simple operation of suprapubic cystostomy is contra-indicated. The presence of a catheter in the urethra is so often ill-borne in cases in which an intense cystitis exists and the frequency of epididymitis in our cases complicating its employment has been such that we have adopted suprapubic cystostomy in the majority of instances in which previously an indwelling catheter was employed. There is, however, a definite group of cases in which the gradual diminution of back pressure on the kidneys or improvement in the cardiac condition is necessary before the operation of cystostomy is permissible. In these cases the indwelling catheter has a definite field of usefulness.

Group III includes cases with small contracted bladders severely ulcerated and giving rise to distressing symptoms. The existing infection has generally invaded the upper urinary tract and pyelitis, pyelonephritis, or pyonephrosis are serious complicating factors. Hydro-ureter and hydronephrosis are concomitant associates in certain long-standing cases in which the infection is confined to the bladder.

The obstruction at the vesical neck in cases belonging to this group is frequently of the stricture variety and of inflammatory origin, or if the obstructive factor is an adenomatous mass it is usually of the horse-collar or ball-valve type. The bladder con-

tains little or no residual urine. These patients bear instrumentation badly, and epididymitis is a frequent complication. On account of hematuria, urinary distress and toxemia of both bacterial and renal origin, the vitality of the patients is at a low ebb when they first present themselves. This group offers the least chance of operative cure, and prostatectomy is not infrequently a complete failure even as regards symptomatic relief. Attempts should be made along the lines already suggested to improve the general condition, and in this effort sedatives and tonics play an important part. Despite the most careful treatment it often becomes necessary to drain the bladder at a time when under other circumstances prolonged preoperative treatment would be advisable. The mortality is high in this group and the morbidity dependent upon operative complications is great; fortunately this group comprises the minority of cases. The differential diagnosis between this variety of vesical obstruction, vesical tuberculosis, and carcinoma of either prostatic or bladder origin is oftentimes made with great difficulty.

There are many gradations between the clear-cut, clinical pictures of the foregoing groups; each case is more or less a clinical entity and should be treated as such. The general application of the principles of preoperative treatment outlined above will serve, however, to illustrate the plan of treatment to be employed in the individual case as it approaches one or the other of these groups.

I have already remarked the increasing frequency with which we are adopting the two-stage operation, and have in a general way defined the indications for preliminary suprapubic cystostomy. The two-stage procedure is now employed in all cases in which catheterization fails to relieve promptly and permanently the effects on the kidneys of back pressure. This method is likewise employed in all cases regardless of the ease or difficulty of improving kidney function by other means when an active urinary infection exists. Finally, it is our method of choice in that considerable group of cases in which doubt exists as regards the ability of the patient to withstand the one-stage operation

of suprapubic prostatectomy. It has been our experience that the two-stage operation by the suprapubic route is the safest and surest way to relieve obstruction at the vesical outlet.

The patient is operated in the Trendelenburg position. Although the preliminary cystostomy may be done under infiltration anesthesia, I never use it. In the absence of definite contra-indications the use of ether by the drop method, gas and oxygen, and occasionally, for example, a patient with a very high blood-pressure, chloroform. Intraspinal anesthesia is rarely used; we regard it as a dangerous anesthetic.

The prevesical region is exposed through a right rectus muscle-splitting incision. The incision is placed over the lower, inner border of the muscle, but care is taken to avoid the midline. It should be of sufficient length to give ample exposure of the bladder. The two portions of the muscle are retracted laterally and a small piece of gauze placed in the upper angle of the wound. The piece of gauze with the upper angle of the wound is retracted upward; this piece of gauze also serves the purpose of protecting the peritoneum against injury, at the same time putting the prevesical tissue on the stretch, thus rendering further dissection more certain. The prevesical tissue is cut through, not torn through or scraped away by blunt dissection or with gauze. The veins in the prevesical tissue are avoided if possible, and if not, are cut and ligated. The bladder wall is now exposed and grasped or steadied with a pair of small tissue forceps and cut through as near the summit as possible, when a pair of retractors are introduced into the bladder and traction made laterally. The cavity of the bladder is now mopped dry with small pieces of gauze, palpated, and inspected; stones are sought for, and if found are removed and careful inspection of the prostate made. A rubber drainage tube, one-quarter to one-half inch in caliber, with a lateral opening in the lower end, is introduced into the bladder and carried down so there is perfect siphonage of the bladder cavity. The bladder wound is closed up to and close to the tube, where it is anchored by an iodin catgut suture passed through either half of the rectus and blad-

der wall and the suture tied down upon the rectus beneath the anterior sheath. The margins of the incised prevesical fatty tissues are brought together with interrupted iodin catgut sutures, a small piece of rubber dam placed in the prevesical space, and the wound of the soft parts closed. The tube is held in position by carrying a silkworm-gut suture through the skin and anterior sheath of the rectus muscle as well as the side of the tube.

Before tying the latter suture, by introducing fluid through the drainage tube, it is definitely determined if the tube is properly placed so that siphonage will be perfect, otherwise the silkworm suture must be removed and the tube lifted or placed at a deeper level. The anterior rectus sheath is closed with a running iodin catgut suture and the superficial wound closed with one or two through-and-through silkworm-gut sutures, including the anterior sheath. The wound is dressed and the patient returned to bed.

Preliminary drainage of the bladder is continued until the maximum physical efficiency of the patient is demonstrated by the various tests already described, which is usually about two weeks. Enucleation is done under ether or gas-oxygen anesthesia, occasionally chloroform in a patient with high blood-pressure; rarely do we use spinal anesthesia. The original ventral incision is reopened above and below the drainage tract to the extent necessary to permit free manipulation within the bladder. During the time of healing after the performance of the first stage of the operation the prevesical and perivesical tissues adjacent to the incision have become fibrosed and their contained lymphatics obliterated. The healthy tissues are in this manner walled off from the operative field of the second stage of the operation. Care should be taken not to break through this protective barrier. The opening into the bladder is enlarged if necessary. In cases with marked intravesical projection the enucleation is begun by tearing through or, in some instances, by cutting through the thin mucous membrane overlying the most prominent lobe. In other instances the dissec-

tion is begun in the urethra after the method of Squier, the line of cleavage between the adenomatous masses and their sheath being sought for through the roof of the prostatic urethra anteriorly. In the majority of instances in which the hypertrophic enlargement of the prostate projects itself into the bladder the sphincter muscle has been pushed aside and is in little or no danger of injury during an enucleation begun from the vesical aspect after the method of Freyer. When the most prominent nodules present themselves in the urethra the method of Squier has the advantage that the sphincter is in less danger of injury than with the Freyer method.

Hemorrhage immediately following prostatectomy is usually due to incomplete removal of the encapsulated mass, and for the same reason that retained secundines cause uterine bleeding. In both instances natural hemostasis is prevented because of the impossibility of firm contraction of muscles surrounding cavities. In the event of profuse hemorrhage immediately following the extraction of the gland which is not easily controlled by pressure temporarily applied it is my practice to enlarge the wound sufficiently to give free access to the prostatic bed. A purse-string or overrunning suture of plain catgut is then placed in the mucous membrane forming the margins of the cavity, which is then packed firmly with a single strip of gauze, the free end of which projects through the parietal incision through the bladder wall alongside the drainage tube. The purse-string or overrunning suture is then drawn taut and tied. Uncontrollable hemorrhage has not been known in our work since the adoption of this simple procedure.

The different technical steps in the operation will vary with the several types of obstruction. In those cases dependent upon sclerotic change in the region of the vesical neck and in which total enucleation of the prostate is indicated we prefer the perineal avenue of approach. When the indications exist for the removal of an obstructing bar, or where sclerosis of the bladder orifice indicates the necessity of excision of a wedge from one or more points in its circumference, we much prefer to do the work

through a suprapubic opening under the guidance of the eye, and with a rongeur forceps or a pair of Sir Henry Thompson's prostatic forceps.

Suprapubic prostatectomy is as safe a procedure in expert hands as is the infrapubic operation. In the hands of those of little experience the suprapubic is far safer than the infrapubic operation. Fistula, incontinence of urine, and failure to relieve the obstruction at the vesical outlet are frequent complications of the infrapubic operation that should be practically unknown following the suprapubic operation.

It is my practice in a large percentage of cases to make a circular incision through the mucous membrane and overlying prostatic sheath around the vesical orifice of the urethra and carry my enucleation through this gutter, which, when completed, does not make any irregularities in the mucous membrane such as have been known to offer subsequent obstruction and require their removal for restoration of function.

Rigid adherence to the modern principles of preoperative treatment is of greater importance, however, so far, at least, as immediate mortality is concerned, than either the method of approach or the technic of its execution.

SOME FURTHER DATA ON ARTIFICIAL IMPACTION OF THE HIP

By FREDERICK J. COTTON, M.D.
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I PROMISED a bit more than I can fulfil, namely, an account of results (including my more recent cases) of artificial impaction in loose hip fractures within the joint, and I must ask your forbearance if I only do the best I can and report those cases on which I have data on hand.

First, may I say that I am more than ever convinced that the average result of our hip fractures has been entirely misunderstood, and therefore misstated. I believe that the cases treated in our general hospitals here (and there is no reason to believe us peculiarly accursed) will show well under two-thirds, probably under one-half of functional good results—anything anywhere near restoration of walking power in hip fractures in all adults (to say nothing of the aged), whether intra- or extracapsular in type.

The failure to accomplish results in the *extracapsular* fractures of the neck has been one purely of failure to understand the situation and to meet it by adequate care in reduction, and particularly in after-treatment.

So far as I have been able to learn from my own cases and from many others, seen or read of as reported by other men, I can only conclude that non-union in these extracapsular cases is a negligible factor—that the question is only that of fixation carried out in such a way as to insure, after reasonably accurate reposition of the fragments, that avoidance of adductor con-

tracture which is so important a part of the after-treatment not only of hip fracture, but of all lesions of the hip-joint. Apparently adduction contracture is an important, if not the chief, factor in the disability of most hip injuries that do badly.

Whether this feature is best to be combated by the method of Phillips, Maxwell and Ruth—the method of traction in abduction combined with lateral traction—or by the method for which Whitman has made large and repeated claims—fixation in abduction after manipulation—or by Moore's scheme of abduction in flexion in the so-called "frog-spica"—which of these is the best in this particular class of cases I do not feel that I am qualified to say.

I have used the first method once with success.

I have used the second and third repeatedly.

Whitman's method *in this class of cases* has given poor reduction, with overlapping of fragments, in two cases. In the other cases of this class it has worked out well.

Moore's method has a very definite advantage in that one may "sit up" these patients, without mechanical damage, *immediately*.

It has the *disadvantage* of involving flexion of the knees, and in all my cases, including artificially impacted fractures and open operations, as well as simple extracapsular fractures, there has been a good deal of trouble after use of this spica in "limbering-up" the knees of the stiff old people who, in practice, are the ones who break their hips.

All these cases have eventually done very well, and I think that if we are to adopt abduction as a schematic treatment for *extracapsular* fractures, abduction should be abduction in flexion, in the double "frog plaster"; but I am a bit uneasy about recommending this for big hospitals, because t e method, good as it is, requires an efficiency in after-care that cannot always be secured.

As to the intracapsular cases the situation is different. Among these some come to us already impacted by the fall that broke the bone, and in fair position.

In these cases there are but two things to do: (1) guard against adductor spasm and eventual contracture of the powerful adductors, and (2) minimize eversion. This last does not necessarily mean forcible correction (loosening up of the impaction) but may be carried out, as I have done it repeatedly, by gradual correction with sand-bags to the best position attainable in the given case, without spoiling the impaction.

But, whatever the treatment, in a certain number of these cases we are going to lose out!

There is always a marked absorption of the bone of the femoral neck in this class of cases. This does not occur in the extracapsular cases, and varies very greatly in amount in different intracapsular cases.

We have been familiar with this absorption in the cases primarily loose—entirely unimpacted, in which cases the absorption is very rapid, but we have not understood that the process is *universally* present, nor have we understood its importance.

In every case of intracapsular fracture, whether impacted or not, and even if it is only a crack, careful *x*-rays at intervals show an absorption with porosis of the bone and with shortening of the neck, and often with a bending of the neck into coxa vara.

Even if repair is fully satisfactory this occurs, along with the repair; if the bone-forming power is poor, the softened bone fails to hold the impaction and the fracture simply falls apart. I shall presently show a series of plates exemplifying this, and I believe this occurrence to be common. Again and again I have looked up old hospital cases, down in the records as impacted, and with *x*-rays that I accepted as showing impaction, in which the hip proved to be loose when I found them a year or two later. Most of these were the other fellows' cases, often sent out in a month on crutches, but I have had this thing happen to two cases with apparently firm impaction while they were in bed under the best care I knew how to give them. I believe the occurrence is not unusual, often unavoidable. It is an argument for long protection and late weight-bearing in all these cases.

I am perfectly ready to have weight on the *extracapsular*

cases at two months but have made it a rule to have the *intracapsular* cases, whether impacted by accident, or by me, kept in plaster three months, no weight for four months, and full weight only at six months.

And even at this I know I am going to have failures.

What we need is to know what happens to our cases. So far from their all doing well, I think the intracapsular cases in particular do badly under ordinary treatment in a majority of the cases, and shall continue in this belief till somebody comes across with end-result figures to match the assurance that "they all do well under my system."

They do not under my system—or any system!

Now as to the impaction proposition. It concerns itself only with a small class of broken hips, namely with the intracapsular or subcapital fractures, the fractures of the neck proper—whatever you choose to call them—in which, and only in which, there is no impaction present, or in which the deformity, especially the eversion deformity, is extreme.

The operation puts these cases into the much more fortunate class of firmly impacted fractures, in improved, often in perfect, position.

They are then to be treated exactly like the cases of accidental impaction, and are of no better prognosis save that the average position is much better and the impaction perhaps firmer.

Many of my friends say that artificial impaction is impossible, and that I do not do it. I can only say that some of you and a good many other competent surgeons have seen the thing done—very sceptical some of them were, too, and they have without exception been convinced of the fact that it *can be done*—irrespective of course of the natural difference of opinion as to whether it *should be done*. Now as to the cases, I have had but 13 cases since the last report.

Case I.—A case of a woman, aged sixty years, operated on for J. Bapst Blake seven weeks after the injury, operated on, I confess, partly to demonstrate the method at the time I showed some end-results before the Clinical Congress of Surgeons here

in October, 1915, without great hopes of success so long after the injury. The impaction seemed to be successful, the foot no longer flopped outward and the trochanter moved in the long arc, not on its own center. This was verified by Murphy, Peck and others of our fellows. Position was maintained well until discharge. After that she had only the care possible in a well managed pauper institution. The clinical result is nothing to boast about. The woman is old, broken, and feeble. Whether the result here is a bony or a close fibrous union is perhaps debatable. In either case I submit that it is much better than one gets in untreated unimpacted cases.

I do not feel, however, that my operation should be advised with any optimism in cases after three or four weeks—perhaps not after two weeks. Smoothing off and cicatrization of the broken ends probably occurs early, and any impaction produced late is not the desirable mutual impaction of clean bone surfaces of full reparative power.

FIGS. 1, 2 and 3.—Case III.

Fig. 1 shows the case before operation.

Fig. 2, six weeks later. *X*-ray taken through plaster; position almost perfect; impaction apparently solid; interpenetration of fragments seems considerable.

Fig. 3 shows at three and a half months, before any weight-bearing, no giving-way of the impaction but a well-marked shortening of the neck from interstitial absorption going on with the repair; bony union seems solid.

Case II.—A woman, aged forty-two, operated at the New England Hospital for Women and Children. This woman had advanced tabes and various tertiary lesions. She fell and broke her hip. I impacted it, and, under the usual routine obtained a bony union, with little deformity or shortening. At the end she had very nearly the function limited by her old locomotor trouble.

Case III.—Mrs. M., aged fifty-six years, operated on for Dr. Elizabeth Gray at the New England Hospital for Women and Children. A fresh case of entirely unimpacted hip fracture. I have no late *x*-rays of this case but I have seen her within the week. She can walk without support though she is apt to use one crutch or a cane if long on her feet. The shortening is just under an inch. Her disability is largely one of defective muscle power. The fracture is immobile and corresponds to all clinical tests of a bony union.

Figs. 4 and 5. Case IV.

Fig. 4 shows the unimpacted fracture.

Fig. 5. the condition not quite three and a half months later. There is slight deformity; there is apparently firm bony union at the center of the neck but it is encroached on at top and bottom; there are spaces that look doubtful.

Case IV.—Mrs. G., aged sixty-three years, operated on at the Cambridge Hospital, April 13, 1916 for Dr. August. A type case of loose fracture operated on as usual. She is now walking after a year fairly well with one crutch or a cane. The hip is solid and painless. The defect, such as it is, is one of muscle power.

Case V.—A. B., aged forty-eight years, operated at the Cambridge Hospital, July 14, 1916, for Dr. Dudley. Usual case of unimpacted fracture, treated like the others. Impaction and position maintained for four months. Union apparently solid then. I have been unable to locate her to see the end-result.

Case VI.—Mrs. N. C., aged sixty-two years, operated for Dr. Horace Stevens at the Cambridge Hospital, June 21, 1916. A type case, operated on in the usual way. Seen May 28 she had obviously firm bony union—a shortening of less than half an inch, over half the normal motion, and can walk. She is still

FIGS. 6, 7, 8 and 9.—Case VII.

Fig. 6, before impaction.

Fig. 7, after impaction. *X*-ray through plaster after two weeks; position practically perfect.

Fig. 8, after two months; bony union in lower half of the neck; a gap still seems to be present above. (Compare Fig. 5.) Progressive *x*-rays, not here reproduced, show the gradual filling of this gap from below.

Fig. 9, the end-result, solid bony union, clear across; only trifling absorption or deformity.

using a cane. What disability remains in this case is largely muscular. The hip is solid.

CASE VII.—Mrs. R., operated on at the Brigham on request of Dr. Cushing, January 5, 1916. The usual findings and the usual procedure and after-treatment.

This case is interesting because we can trace the bridging across by bone of part of the defect that long continued fibrous. In this case the woman showed, at fifteen months, excellent function and bony union.

CASE VIII.—M., operated for Dr. Blake. Reduction and impaction went well. End-result not known. Went "O. P. I." to the city hospital on Long Island.

CASE IX.—Operated for Dr. Blake. Everything all right up to discharge. Went to the City Hospital on Long Island. End-result not ascertained.

FIGS. 10 and 11.—Case VIII.

Fig. 10, before impaction.

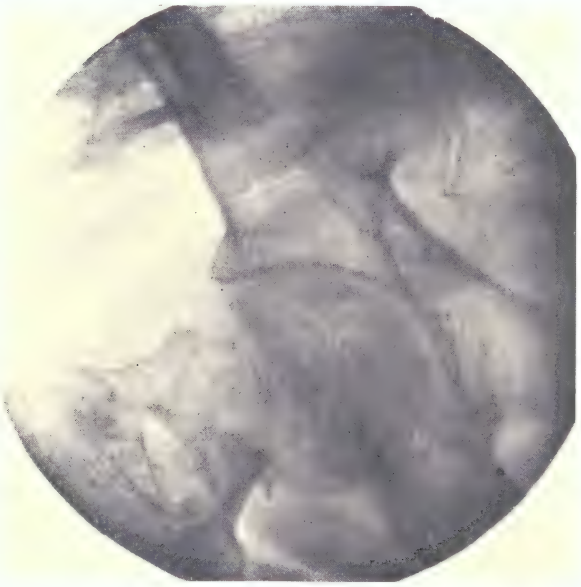

Fig. 11, five days later, after impaction; position good; interpenetration of fragments sufficient, apparently.

Case X.—S., old, broken man, aged sixty-odd years. Probably not a fit case for operation. Reduction and impaction went well, but after removal of the spica at three months the limb gave way, then there was not even an attempt at union.

Case XI.—Mrs. McG., aged sixty-five years, looking at least ten years older. Operated for Dr. Harvey Cushing. Type case, type procedure, December 6, 1916. Reduction excellent but absorption unusually great. Up to February 21, the cast was kept on for two and a half months. The skiagraph a week later showed the impaction still obvious. After another week the coxa vara had increased but the impaction seemed still serviceable. April 24, at four and a half months, the impaction had entirely given way despite all care. This case was a failure. Whether harder impaction or better after-care would have done better I do not know.

CASE XII.—A woman, aged fifty-eight years, type case. Operated on December 23, 1916, with the type of procedure as usual. Reduction was satisfactory and everything looked favorable enough until she died after twenty-one days of myocarditis.

CASE XIII.—Mrs. McD., aged sixty-nine years, type case. Usual operation December 23, 1916. This case has gone on well, though, perhaps because she was extremely fat about the hips, I did not get as good a reduction as usual. She is still at the Newton Hospital and is beginning to walk about fairly well with a crutch. Union has not given way and I expect her to regain pretty near full function.

Now this series chances to be almost entirely of cases operated on for others at outlying hospitals, and in most instances under circumstances precluding the after care as to massage and passive motion, that means so much in the regaining of function.

As to functional results this series leaves a good deal to be desired.

As to anatomical results it shows that artificial impaction may give way months afterward, just as accidental impaction does in individuals whose bony as well as general nutrition is low.

Both the cases in which this happened were very old and feeble. But I submit that this series does support my contention that the unimpacted cases can be reduced and can be impacted so as to give them at least the chance of good results normally due in case impaction is originally present.

DISCUSSION

Dr. John Bapst Blake, Boston:

The reason Dr. Cotton performed these operations for me is because he can do them better than I can. The average man cannot impact an intracapsular fracture unless he makes a long and careful study of this technic. In the first case, of which Dr. Cotton spoke, I did not believe it could be done; the fracture was nearly seven weeks old, and in poor position, yet he convinced me, and most of the rest of us at the Congress before which he operated, that he did improve it.

Life in Boston is exhilarated nowadays by a constant stream of letters written from Whitman, of New York, to Cotton, of Boston, vituperative yet friendly, upon the subject of fractures of the femoral neck. Seriously speaking, I think it has been demonstrated that in the hands of an expert, and in a small number of cases, it is possible and desirable to impact a fracture of the femoral neck. There is an enormous number of these fractures at the Boston City Hospital. The use of the Bradford frame; keeping the foot vertical, and preventing weight bearing for six months give good results, much better than the older methods formerly employed. I have found in putting on the plaster, after the method of Whitman, that two things may happen; we often get bed-sores on the ilium and over the sacrum, and some of the old patients vomit persistently for a long period. A Bradford frame made extending out over the side of the bed, and abducting the leg, would give many of the advantages of a plaster spica, which are unquestioned; it does not give a rigid immobilization of the plaster and subsequent vomiting. One of the uses of extension in these cases is by applying a small amount of weight, from five to eight pounds, in reality producing but trifling extension, but acting as an aiding immobilizing force, helping to keep the toe up, and to keep the patient quiet. Clinically, the improvement in this group of fracture of the neck of the femur, by the treatment outlined above, has advanced greatly in the last twenty years, and the results are much better than those obtained twenty years ago.

THE HANDLING OF EARLY AND DOUBTFUL CASES OF CANCER

By ROBERT B. GREENOUGH, M.D.
BOSTON, MASS.

In January, 1917, the Cancer Commission of Harvard Univeristy offered to supply to the medical profession of Massachusetts the services of their laboratory for the free diagnosis of suspected cancer tissue. This offer was made at the instigation of the Committee on Cancer of the Massachusetts Medical Society, and was in accordance with the movement which originated in the American Society for the Control of Cancer for the provision of facilities for free diagnosis of cancer tissue throughout the country, based upon the report of a committee of that society, composed of Dr. James Ewing, of Cornell, Dr. F. C. Wood, of the Crocker Fund, and Dr. L. D. Bristol: published in the *Journal of the American Medical Association*. In that report the concluding recommendation "D" reads as follows: "Judgment must always be used by surgeons in the removal of cancerous tissues for diagnosis, and the value of microscopic diagnosis should appear to outweigh the risk involved before such a procedure is adopted." The wise caution here expressed has not always been followed in the removal of tissue for diagnosis.

The offer of free laboratory service was made to the Health Commissioner of Massachusetts and was accepted by the Health Commissioner, Dr. A. J. McLaughlin, subject to the issue of such rules and suggestions, to be issued to the profession at the time of the announcement of the service, as should be deemed

advisable by the Commissioner of Health and by the Cancer Commission of Harvard University.

In the preparation of those rules and suggestions the writer at once became aware of the fact that a considerable part of the medical profession held strong views, and views which were not always in agreement, upon the subject of the propriety of the excision of fragments of tissue for pathological diagnosis in cases of suspected cancer. At about this time the announcement of a similar service for the free diagnosis of pathological material was made by the Health Commissioner of New York City, and a storm of criticism immediately arose in the medical publications of that city. Under these circumstances the writer ventured to prepare the circular letter dated March 20, 1917, copies of which were sent to all of the Fellows of this Association and to the members of the Clinical Surgical Society, the American Gynecological Association, the members of the American Association for Cancer Research, and the directors of the American Society for the Control of Cancer. The letter is as follows:

10 Gloucester Street, Boston,
March 20, 1917.

Dear Doctor:

The American Society for the Control of Cancer has placed itself on record as favoring the institution of free diagnosis of pathological material throughout the country. In so far as this movement provides for the examination of material removed by radical operations, performed for the cure of cancer, there is no room for adverse criticism. So far, however, as it applies to the excision of small pieces of suspected tissue in order to establish a diagnosis, its wisdom has been the subject of some discussion. This circular letter is sent to the members of the American Association for Cancer Research, the American Surgical Association, and the American Gynecological Association, in order that a collective opinion in regard to the safety of procedure in specific cases may be obtained. Will you be kind enough to state whether or not you approve of the procedure

indicated in the following list of lesions, and if you do not approve, will you be kind enough to state your opinion as to what procedure should be recommended? Please bear in mind the fact that an immediate frozen section diagnosis of suspected material is not in question, but that these recommendations have to do with the removal of suspected tissue, and its shipment to a laboratory, for diagnosis, involving a delay of at least a week before the pathological report can be obtained. Bear in mind, also, that the question has to do only with early and doubtful cases in which a positive diagnosis of cancer cannot be established with sufficient certainty to justify radical operation.

Trusting that the importance of the matter justifies the amount of trouble involved in answering these queries and with cordial thanks for your coöperation, I am,

Very truly yours,

ROBERT B. GREENOUGH.

PROCEDURE RECOMMENDED IN THE DIAGNOSIS OF EARLY AND SUSPECTED CANCER OF DIFFERENT ORGANS

(1) LESIONS OF THE EXTERNAL SKIN. If small, complete excision of the lesion. If large, excision of a portion of the growing edge of the lesion, followed by cauterization.

Opinion:

(2) LESIONS OF THE LIP. If small, V-excision, with a good margin, of the whole lesion. If large, excision of a portion of the growing edge of the lesion, followed by cauterization.

Opinion:

(3) LESIONS OF THE TONGUE. Excision of the whole lesion, or if large, excision of a portion of the growing edge, with cauterization.

Opinion:

(4) LESIONS OF THE PALATE, TONSIL AND THE BUCCAL MUCOUS MEMBRANES. Excision of the margin of the lesion, and cauterization.

Opinion:

(5) LESIONS OF THE ESOPHAGUS. Esophagoscopy, and excision of the margin of the lesion.

Opinion:

(6) Lesions of the Stomach. Pylorectomy; gastrectomy, or primary gastro-enterostomy, to be followed at a later operation, if necessary, by gastrectomy.
Opinion:

(7) Lesions of the Small Intestine and Colon. Excision, with anastomosis.
Opinion:

(8) Lesions of the Gall-bladder. Cholecystectomy.
Opinion:

(9) Lesions of the Liver. If cancer, generally secondary to cancer elsewhere. Exploratory excision rarely necessary or advisable.
Opinion:

(10) Lesions of the Rectum. Excision of a portion of the growing edge of the lesion, with cauterization.
Opinion:

(11) Lesions of the Kidney. Nephrectomy.
Opinion:

(12) Lesions of the Bladder. Cystoscopy, and excision of a portion of the lesion.
Opinion:

(13) Lesions of the Prostate. Prostatectomy.
Opinion:

(14) Lesions of the Testicle. Orchidectomy.
Opinion:

(15) Lesions of the Cervix of the Uterus. (*a*) Excision of the lesion; (*b*) amputation of the cervix; (*c*) excision of a fragment of tissue, with cauterization.
Opinion:

(16) Lesions of the Fundus of the Uterus. Curettage.
Opinion:

(17) Lesions of the Ovary. Oöphorectomy.
Opinion:

(18) Lesions of the Breast. Local excision of tumors of the breast suspected of being malignant, and submission of the tissue for subsequent pathological report cannot be recommended. If direct incision with frozen section diagnosis is not possible, amputation of the whole breast, with dissection of the axilla should be performed in suspected cancer in women over thirty-five years of age.
Opinion:

(19) Lesions of the Lymph Nodes in the Neck, Axilla, and Groin. A block dissection of the area involved, including the adjacent lymph nodes, is to be recommended in preference to the excision of a single suspected node.
Opinion:

(20) Sarcoma and Obscure Tumors Deeply Placed. Exploratory removal of tissue for subsequent pathological examination cannot be recommended. Facilities for direct exploration and frozen section diagnosis should be secured, before radical operation, such as amputation, can be justified.
Opinion:

(21) In general, superficial and ulcerated lesions may safely have fragments of tissue removed, especially if a cautery is used to seal the lymphatics, whereas in deep tumors, where the exploratory excision necessarily opens up normal tissue to infection, exploratory excision, unless followed immediately by operation at the same sitting, is to be condemned.
Opinion:

The writer would here express his thanks to the many members of these societies who have taken the pains to read and answer the numerous inquiries in this circular letter. The subject appeared to be one of such vital importance to the general policy of the campaign to obtain better treatment for cancer cases as to justify the attention and effort of those best suited to give expression to authoritative opinion. The response to the questionnaire has been most gratifying, and it is to announce and to discuss the opinions thus obtained that this communication has been prepared.

As was stated in the circular letter the use of the immediate frozen section diagnosis of suspected tissue was not submitted for discussion. It is quite beyond the possibilities for such service to be rendered by any cancer commission or public health laboratory. It must be provided, if at all, by the resources of the individual hospital or operator. In general it may be said that the immediate frozen section diagnosis of suspected material offers, probably, the least dangerous method of obtaining light on the diagnosis of cancer tissue—that is, least dangerous to the patient as regards the artificial spread of the disease, but not, unfortunately, free from danger as regards the possibility of erroneous diagnosis. I have known the frozen section method to fail in such an instance as this: A breast suspected of being

malignant is removed *in toto*; the pathologist present at the operation makes numerous sections of the tissue, and cuts frozen sections of the suspicious areas; no cancer is found; the operation (an incomplete one) is finished, without dissection of the axilla. After ten days the pathologist discovers, in the routine paraffin section, that there is an area of cancer which escaped observation in the frozen section. The method is thus at fault in that it appears to give an accuracy that does not in fact exist. Such an occurrence as above detailed is probably known to many of you. It is the weak link in the frozen section chain and must not be disregarded in estimating the value of the procedure.

When we speak of free diagnosis of suspected cancer tissue, however, we are speaking of the service which may be rendered by one or more central laboratories, involving the removal of tissue, placing it in tissue preservatives, sending it to the laboratory, and waiting for a certain length of time, say seven days, for a positive report. Under these conditions we must make up our minds when and where, if at all, the removal of fragments of tissue suspected to be malignant can be justified and recommended. One of the most widely accepted principles in the surgery of malignant disease is that cutting into cancer tissue leads to a spread of the disease. The proofs of the truth of this assertion are so common in the experience of every practising surgeon that examples are scarcely needed; but I may say that in my own experience not one case of cancer of the breast has been saved in which a primary local operation has been done under the erroneous diagnosis of a benign tumor, even when followed at an interval of seven to ten days, by the most complete operation, when the pathological examination of the original tumor disclosed malignancy. With regard to other situations it is probable that the danger is not so great, but it is difficult to draw the line, and eighteen Fellows of the American Surgical Association in their replies stand squarely by the general proposition that exploratory incision into cancer tissue is *never* justified. In this connection, however, it must be said that we are looking at this matter from the point of view of preserving the patient's

chance, such as it may be, for a successful operation for the radical cure of the disease. When we are dealing with a case of presumably inoperable cancer the same conditions do not hold. It is not then a matter of preserving the patient's chance for radical cure; it is, rather, a question of saving him a serious operation which may quite possibly be of no benefit. Under these circumstances the removal of a single node above the clavicle, and the pathological report that it is malignant, may save a useless operation for cancer of the stomach or for hypernephroma. In this same category belong, I believe, many of the exploratory incisions for tumors of the cervical lymph nodes in which the diagnosis rests between tuberculosis, Hodgkin's disease, and carcinoma or sarcoma. If carcinoma or sarcoma, radical operation is probably out of the question, and the removal of a single node does little, if it is malignant, to hasten the end, and may give information of tuberculosis or Hodgkin's disease which will lead to appropriate treatment and beneficial results. In cases of this class the objections to the exploratory incision are obviously less than when the possibility of radical operation is still to be considered.

Before stating the replies, as they have been received to the specific questions in regard to cancer in different situations, it is interesting to note that consistency is just as rare a characteristic among medical men as it is among other human beings. We all have our principles, and we want to live up to them, but we rarely succeed in every instance. The exploratory incision into cancer tissue is, in fact, a confession of weakness—of the inability to make, from external signs and symptoms, a diagnosis of sufficient certainty to stand the crucial test of a mutilating operation. It is a curious and interesting fact that the individual surgeon advises the application of the exploratory incision chiefly in these cases with which he is least familiar, and where he finds it hardest to make an early but positive diagnosis. Most of us advise against exploratory incision in breast tumors, but think it sometimes permissible in cancer of the tongue. Many surgeons perform a total hysterectomy in

preference to an exploratory excision for suspected cancer of the cervix, or in preference to a curettage for doubtful cancer of the fundus. When it comes to such mutilating operations as those for radical cure of cancer of the tongue, or jaw or larynx, however, we most of us want the support of a pathological report before the operation is undertaken in the doubtful cases; and yet the principle is the same, and the danger of the exploratory incision is probably just as great. It is in such cases as this that it is difficult to be consistent.

Replies were received from 69 Fellows of the American Surgical Association, 41 members of the American Gynecological Association, and 24 members of the American Association for Cancer Research and the American Society for the Control of Cancer—a total of one hundred and thirty-four letters. Not all were willing to commit themselves to a detailed expression of opinion, but the views expressed were invariably of interest, and many points were suggested for more detailed discussion.

Seventy-two out of seventy-three replies favored removal of the whole of any small suspected nodule of the external skin. Exploratory excision of a fragment in larger tumors of the skin was approved by fifty-eight, but twenty-six objected to it as a dangerous procedure.

The replies in regard to suspected lesions of the lip and tongue were practically the same. All agreed that if small the whole lesion should be removed; if large, nearly one-third (80–29) of the replies expressed disapproval of the proposed removal of a fragment and cauterization of the wound.

When it came to the suspected lesions of the palate, those who disapproved of the exploratory excision were fewer in numbers, but they were very emphatic that the procedure was a dangerous one (57–24). This is undoubtedly due, in part, at least, to the grave prognosis of cancer of the palate under any conditions, for in suspected cancer of the esophagus those objecting to the exploratory excision of tissue were still less in number (13), and some of them objected not on account of the spread of the disease but because of the danger of perforation.

	Surgeons.	Gynecologists.	Pathologists.	Total.
1. External skin				
(*a*) Small—excision				
Pro	59	11	2	72
Con	0	0	1	1
?	0	0	0	0
(*b*) Large—fragment				
Pro	32	15	11	58
Con	25	0	1	26
?	0	0	0	0
2. Lip				
(*a*) Small—whole				
Pro	57	12	11	80
Con	1	0	1	2
?	0	0	0	0
(*b*) Large—fragment				
Pro	29	7	10	46
Con	27	0	2	29
?	0	0	0	0
3. Tongue				
(*a*) Small—whole				
Pro	57	11	12	80
Con	0	0	0	0
?	1	0	0	1
(*b*) Large—fragment				
Pro	29	11	9	49
Con	27	0	2	29
?	0	2	0	2
4. Palate				
Fragment				
Pro	38	9	10	57
Con	20	1	3	24
?	2	1	0	3
5. Esophagus				
Fragment				
Pro	37	10	6	53
Con	9	1	3	13
?	10	4	0	14
6. Stomach				
Whole				
Pro	56	15	10	81
Con	0	0	0	0
?	1	2	0	3
7. Intestine				
Whole				
Pro	59	19	10	88
Con	0	0	0	0
?	0	1	0	1
8. Gall-bladder				
Whole				
Pro	58	16	11	85
Con	0	1	0	1
?	0	1	0	1
9. Liver				
Pro	51	18	10	79
Con	7	2	0	9
?	0	0	0	0
10. Rectum				
Fragment				
Pro	37	16	10	63
Con	20	3	2	25
?	1	1	0	2
11. Kidney				
Whole				
Pro	56	20	9	85
Con	3	1	0	4
?	0	1	1	2

	Surgeons.	Gynecologists.	Pathologists.	Total.
12. Bladder				
Fragment				
Pro	39	18	8	65
Con	15	2	1	18
?	5	0	1	6
13. Prostate				
Whole				
Pro	52	11	6	69
Con	5	0	2	7
?	4	3	2	9
14. Testes				
Whole				
Pro	57	11	9	77
Con	2	0	0	2
?	0	3	1	4
15. Uterus (cervix)				
(*a*) Excision				
Pro	25	9	5	39
Con	28	22	7	57
?	2	0	1	3
(*b*) Amputation				
Pro	30	9	4	43
Con	22	21	7	50
?	0	0	1	1
(*c*) Fragment				
Pro	26	17	9	52
Con	26	15	2	43
?	0	0	1	1
(*d*) Cautery excision	..	..	..	5
16. Uterus (fundus)				
Curettage				
Pro	36	28	9	73
Con	12	7	3	22
?	5	1	2	8
17. Ovary				
Whole				
Pro	26	31	12	69
Con	1	1	0	2
?	2	1	0	3
18. Breast				
Whole				
Pro	50	21	9	80
Con	6	3	1	10
?	3	2	1	6
19. Lymph nodes				
Whole				
Pro	47	17	8	72
Con	7	4	3	14
?	3	2	1	6
20. Sarcoma				
Whole				
Pro	54	19	9	82
Con	2	0	1	3
?	1	1	0	2
21. General				
Fragment or whole				
Pro	44	21	11	76
Con	9	0	1	10
?	5	1	3	9
Cautery				
Pro				24
Con				11
No incomplete operations				17
Pro-biopsy in general				8

When it comes to suspected cancer of abdominal organs, like the stomach, intestine, gall-bladder, etc., the total removal of the suspected organ or tissue is advocated in practically every case. This is undoubtedly due to the fact that the operation for cancer differs but little from that for benign lesions in its severity or in the disability resulting.

In suspected cancer of the rectum, 64 are in favor of the exploratory excision of tissue and 25 are vigorously opposed to that procedure—a number of conscientious objectors large enough to make us pause to consider whether their position is not well taken. About the same proportion exists in regard to the exploratory excision of tissue with the cystoscope in suspected cancer of the bladder—65 are in favor and 18 are opposed to the procedure.

In tumors of the testicle and of the prostate, as might be expected, the removal of the entire organ is the procedure preferred in the great majority of the replies.

When it comes to cancer of the cervix of the uterus the weight of opinion in favor of one or another procedure is not so clearly evident; 39 are in favor and 47 are against simple excision of the lesion for pathological examination; 43 are in favor and 50 are opposed to simple amputation of the cervix; and 52 are in favor and 43 opposed to excision of a fragment of tissue with cauterization of the wound.

In suspected cancer of the body of the uterus, 72 favor diagnosis by curettage and 22 are opposed to this procedure, presumably on the ground that it may lead to dissemination of the disease; 25 replies state that in suspected cancer of the uterus a total hysterectomy should be performed at once without waiting for the microscopic confirmation of the diagnosis—17 of these are Fellows of the American Surgical Association and 7 of the American Gynecological Association. In general the procedure in regard to cancer of the uterus may be said to be still a matter of discussion.

There is a general unanimity of opinion in favor of the total operation in preference to the exploratory operation in cancer

of the ovary—69 to 2, and of the breast 100 to 10—and yet the differences of opinion here are very marked. One surgeon underlines the statement in paragraph 18: "Amputation of the whole breast with dissection of the axilla should be performed in suspected cancer in women over thirty-five years of age;" and queries whether *anything* could do more to discredit the practice of surgery than this advice; while others express their hearty approval of this procedure, and suggest reducing the age limit to thirty or even twenty-five.

Seventy-two agree and 14 disagree with the recommendation against the removal of single suspected lymph nodes, and yet 82 agree and only 3 disapprove of the advice to avoid exploration in deep sarcoma.

Finally, 76 agree and 10 disagree with the general recommendation that the exploratory removal of tissue be restricted to superficial and ulcerated lesions (to be followed by cauterization), and that it be avoided in deeper tumors in which the excision would open up normal tissues to invasion.

In regard to the use of the cautery to seal the lymphatics, after exploratory incision, opinion is not unanimous. Eleven are opposed to its use, chiefly on the ground that the hyperemia resulting causes increased rapidity of growth. Twenty-five express themselves as favoring the use of the cautery in one or another situation as a safeguard against the spread of the disease. It has been the personal belief of the writer that the immediate occlusion of the lymphatics far outweighed in advantage any possible hyperemia and consequent possible increased rapidity of growth which might occur at a later date.

To sum the matter up it may be said that the opposition to the use of the exploratory incision for the removal of tissue suspected of malignancy is very real. Many surgeons believe it is never necessary or advisable; others, and they are the majority, believe that in certain situations it is permissible, when all other resources of diagnosis (in which should be counted the benefits of consultation) have been exhausted, and even then only (1) when the tumor is a superficial one, or (2) when a frozen

section can be obtained immediately and the operation completed under one anesthesia. Under these conditions, and under these conditions only, can the exploratory incision of tumor tissue be justified as a reasonable surgical procedure. If exploratory removal of tissue is to be discountenanced, what becomes of the project for the free diagnosis of suspected cancer tissue? I believe it assumes an importance greater than ever, because it should be applied to all pathological tissues removed for the cure of disease. The function should be a State function, and the report should go to the patient or his friends as well as to the surgeon. It should be the final means of checking up the end-results of the surgical diagnosis and treatment of malignant disease. Only by some such drastic measure as this can the incompetent surgeon be prevented from depriving the patient of his one and only hope of cure of cancer by an early radical operation.

As a result of the analysis of the replies received a modification of the "Procedure Recommended in the Diagnosis of Early and Suspected Cancer of Different Organs" can be made as follows:

1. Suspected but doubtful lesions of the *external skin:* If small, complete excision of the lesion should be performed. If large, excision of a portion of the growing edge of the lesion, followed by cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

2. Suspected but doubtful lesions of the *lip.* If small, V-excision, with a good margin, of the whole lesion, should be performed. If large, excision of a portion of the growing edge of the lesion, followed by cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

3. Suspected but doubtful lesions of the *tongue*. Excision of the whole lesion, if small, should be performed. If large, excision of a portion of the growing edge of the lesion, followed by cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

4. Suspected but doubtful lesions of the *palate*, *tonsil* and the *buccal mucous membranes*. If small, excision of the whole lesion should be performed. If large, excision of the margin of the lesion, followed by cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

5. Suspected but doubtful lesions of the esophagus. Esophagoscopy and excision of the margin of the lesion may be performed, but the danger of perforation of the esophagus must be borne in mind.

6. Suspected but doubtful lesions of the stomach. Pylorectomy, gastrectomy, or primary gastro-enterostomy, to be followed at a later operation, if necessary, by gastrectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

7. Suspected but doubtful lesions of the small *intestine* and *colon*. Excision with anastomosis. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

8. Suspected but doubtful lesions of the *gall-bladder*. Cholecystectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient

to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

9. Suspected but doubtful lesions of the *liver*. If cancer, generally secondary to cancer elsewhere. Exploratory excision, or incision into liver tissue, is rarely necessary or advisable, except to confirm a diagnosis of hopeless malignancy and thus avoid unnecessary radical operation.

10. Suspected but doubtful lesions of the *rectum*. Excision of a portion of the growing edge of the lesion, with cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

11. Suspected but doubtful lesions of the *kidney*. Nephrectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

12. Suspected but doubtful lesions of the *bladder*. Cystoscopy and excision of a portion of the lesion, with cauterization, is to be advised only after all other resources of clinical diagnosis, including consultation, have been employed, and then only when facilities for immediate frozen section diagnosis are available and the operation for cancer, if it prove necessary, can be completed under one anesthesia.

13. Suspected but doubtful lesions of the *prostate*. Prostatectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

14. Suspected but doubtful lesions of the *testicle*. Orchidectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

15. Suspected but doubtful lesions of the *cervix of the uterus:* (*a*) Excision of the lesion; (*b*) amputation of the cervix; (*c*) excision of a fragment of tissue, with cauterization. Opinion is not conclusive. Some advise hysterectomy on suspicion of malignancy. This is undoubtedly radical, but preserves the patient her best chance of cure. Others prefer the exploratory excision of tissue, or amputation of the cervix, to be followed immediately by the complete operation, if frozen section shows cancer.

16. Suspected but doubtful lesions of the *fundus* of the *uterus.* Curettage. Opinion divided. Some advise hysterectomy on suspicion of malignancy. Others advise curettage and immediate frozen section diagnosis.

17. Suspected but doubtful lesions of the *ovary.* Oöphorectomy. Here the difference in the severity of the possible operations for benign and for malignant disease is not sufficient to make an exploratory incision into suspected cancer tissue a necessary or advisable precaution.

18. Suspected but doubtful lesions of the *breast.* Local excision of tumors of the breast suspected of being malignant and submission of the tissue for subsequent pathological report cannot be recommended. If direct incision with frozen section diagnosis is not possible, amputation of the whole breast, with dissection of the axilla, should be performed in suspected cancer in women over thirty-five years of age. This is endorsed by 90 per cent. of the replies.

19. Suspected but doubtful lesions of the *lymph nodes in the neck, axilla, and groin,* in cases where radical operation is a possibility even if cancer is found to be present. A block dissection of the area involved, including the adjacent lymph nodes, is to be recommended in preference to the excision of a single suspected node. Where obviously a hopeless case of cancer is shown to be present, removal of a single node may prevent a useless operation, and is to be recommended.

20. *Sarcoma* and *obscure tumors* deeply placed. Exploratory removal of tissue for subsequent pathological examination cannot be recommended. Facilities for direct exploration and

frozen section diagnosis should be secured in cases in which doubt exists after *x*-ray studies and other clinical means of diagnosis are exhausted, before radical operation, such as amputation, is performed.

21. In general, *superficial* and *ulcerated lesions* are the only ones in which fragments of tissue may safely be removed for microscopic diagnosis. In deep tumors in which the exploratory incision necessarily opens up normal tissue to infection, exploratory excision of suspected tissue is to be condemned, and should be avoided. When other resources of diagnosis have been exhausted, an exploratory excision, with an immediate frozen section diagnosis and immediate performance of the radical operation, if it prove necessary, is the least dangerous procedure for the patient. No suspected tissue should be excised for diagnosis, unless by a surgeon who is equipped to perform immediately the radical operation for the cure of cancer of the organ involved.

To these recommendations may be added the following:

22. The routine pathological examination of all tumor tissues removed by operation, should be made compulsory. To this end competent laboratories for the free diagnosis of pathological material should be maintained as a function of the State.

DISCUSSION

Dr. Ellsworth Eliot, Jr., New York City:

I would like to inquire if an "exploratory incision" of a suspicious growth means that the portion of the tumor so secured is sent to the laboratory, that only after an interval of a number of days the radical operation is completed? This, I believe is dangerous and should be unqualifiedly condemned. If, on the other hand, by "exploratory incision" is meant the incision into the tumor mass for purposes of macroscopic inspection, followed immediately by the removal of the growth, I believe this procedure in doubtful instances is entirely justifiable. I also believe that diagnosis based upon frozen sections is extremely unreliable. In many such instances the diagnosis must be revised after a complete examination. It is perhaps wiser for the surgeon to be guided by the result of his inspection of the divided surface of the tumor than by the result of the frozen section. Although I believe that the exploration of a suspicious growth, followed in a week to ten days by a radical operation favors the dissemination of a malignant tumor and thereby increases the likelihood of fatal metastasis, that such an unfavorable termination has its exceptions is demonstrated by a personal observation, in which a radical operation followed in ten days the removal of a mammary growth, which proved carcinomatous. This patient, who would not consent to the major operation until malignancy was conclusively demonstrated by more than one pathologist, is still free from any evidence of recurrence, six years after operation.

Dr. Edward Reynolds, Boston (by invitation):

In the discussions that I have heard on this subject in the American Society for the Control of Cancer and elsewhere I think that the considerable disagreements that have existed have been largely due to failure to exactly classify the question that is brought up. The question which Dr. Greenough brings up, as I understand it, is whether the free laboratory diagnosis of tissue that has been removed is likely to be a benefit to the community as a whole or not. I take it no competent and fully equipped surgeon would find it necessary to submit sections to the free laboratory for diagnosis and decision. But we must recognize that a large part of the surgery of malignant disease is necessarily done by occasional operators not well equipped. No competent, well-equipped surgeon concludes a partial operation for the removal of a doubtful growth without making sections of that growth. He, then, if the growth is suspicious proceeds to remove it.

If, as must happen to all of us occasionally, even with the assistance of pathologists, he fails to find malignant tissue concludes a partial operation, and a subsequent laboratory examination discovers the presence of malignant tissue no surgeon would hesitate to operate radically then. I believe that free laboratories should decline to examine small segments from growths which have not been entirely removed. I believe, however, that since the immediate examination by occasional operators not well qualified will necessarily include large numbers of failures to detect beginning malignant tissue that such a service on doubtful tumors completely removed by partial operations will do benefit to the community. First, by leading to the performance of subsequent radical operations, and second from the opportunity which it gives us to educate the profession. Gaylord, of Buffalo, has instituted an excellent system in connection with his free laboratory diagnosis, in that after every examination he has a personal letter written to the physician telling him, not only the results but what should have been done in that individual case. With these restrictions I believe such service should be encouraged.

Dr. William H. Carmalt, New Haven:

I cannot see, in this question of endeavoring to decide upon the character of a given tumor by the examination of a small piece excised from the main mass, that we are an iota farther along than we were forty years ago when I was engaged in the study of tumors in Professor Waldeyer's laboratory.

He showed then that in all carcinomata there is a simultaneous growth of both the connective and epithelial tissues; they are all mixed tumors. The essential and characteristic feature, as you all know, is the penetration of the epithelial elements into the surrounding framework of connective tissue; this stimulates the latter into a more or less active participation in the growth. A small piece taken for microscopic examination, may fall solely in the connective tissue portion, leaving the pathognomonic feature, the aberrant epithelial growth, undetected. Hence a negative finding does not establish its non-carcinomatous character, as the immediately next section might contain the characteristic alveolar structure. If one finds this structure well and good, one can then go ahead with confidence, being justified in the radical operation, but if, on the contrary, he finds nothing but an apparently benign growth of fibrous connective tissue, as in the so-called scirrhous (fibrous) carcinomata, he may be betrayed into the fatal error of leaving it until its extension into the accompanying lymphatic glands makes it too late to operate with security.

To one who has studied these tumors, as a whole, with the extirpated mass before him on the laboratory table, the idea of making a diagnosis from a small piece is practically absurd. He makes incisions through many different parts selecting situations which he thinks will show the characteristic structure. Finding it he makes the diagnosis; not finding it he makes a section from another and another part and so on, until he either finds the characteristic structure, or after trying many he comes to a conclusion as to the real nature of the tumor, but not until he has made a thorough examination of the whole mass. How futile then is it to think an approximate diagnosis even may safely be made from a small section taken, one may say, quite at random.

It may be considered presumptuous in one who has not personally worked in this field for many years to speak so positively were it not that I have the support of so eminent an authority as Professor Carter Wood, the director of the Crocker fund for cancer research in Columbia University, known to many of you, who recently in reply to an inquiry as to a positive advance since Waldeyer's time said, No! "Much has been accomplished in the way of eliminating questions brought up from time to time with more or less assumption, but as to actual progress nothing worth mentioning."

It is all very well to try to solve this problem by physical demonstration if you can, to relieve one's self from the responsibility of making a disagreeable verdict in a doubtful case, but as yet I insist we have not arrived at the point of doing away with forming a judgment based upon accumulated experience, clinical symptoms and horse sense, and when in doubt play trumps; in the slogan of the day, safety first!

Dr. Kenneth A. J. Mackenzie, Portland, Oregon:

I appreciate the importance of Dr. Greenough's study and I would like to relate a very recent experience which illustrates it in a very forceful manner. Ten days before I left for the East I had brought to my attention a friend who had suffered for two or three years from vague abdominal symptoms which led to the conclusion on the part of internists that he had some form of trouble involving the cecum, probably a mobile cecum with complications. An exploration was agreed upon and the right side was attacked through a free mid-rectus incision which permitted the inspection of all the viscera. The cecum was brought out and revealed an appendix, the state of which suggested at once important changes. It was curled up tightly like a cockle shell and rested against the mesentery which was thickened and infiltrated over an area of two and a half inches in diameter.

The appendix, together with the infiltrated area of the mesentery, was resected well beyond the involved zone. The glands in the neighborhood were not involved. Examination of the tissues in the gross suggested that the disorder was inflammatory in its origin and that the involved mesentery was fed by an infected appendix. I comforted myself with the thought that there was nothing further to be done. Five or six days later, however, the pathologist announced the tissues to be malignant, the seat of medullary carcinoma. Two or three questions presented themselves: What should be done at once by way of a more radical attack to prevent recurrence? Would it be safe in view of the peculiar findings of the case to leave it alone? The issues were particularly important because of the relation of the man's profession to the war and his desire to enter it.

Dr. Samuel J. Mixter, Boston:

There is a great difference between cutting into a malignant growth to get a piece for examination and at the same time cutting into the adjacent healthy tissue, and cutting out the whole of the small growth for diagnosis. One is dangerous, the other comparatively safe. I was once guilty of inventing the so-called Mixter tumor punch, an instrument that I now think should never be used. You can get a beautiful specimen from even a deep-seated tumor but the danger of spreading the disease is so great that I have tried to forget that I ever saw the instrument.

Dr. R. B. Greenough, Boston (in closing):

I would merely add that the replies received indicate that it is the surgeons who have learned to dread the exploratory removal of fragments of tissue for diagnosis, in cancer cases, and that biopsy is advocated as a general measure by pathologists rather than by surgeons.

THE ROLE OF THE CREMASTER MUSCLE IN THE RADICAL OPERATION FOR HERNIA

By KENNETH A. J. MACKENZIE, M.D.
PORTLAND, ORE.

In performing the Bassini operation for hernia I have found that on systematic section of the cremaster muscle in the axis of and centrally over the cord from the internal ring to a point below the level of the external ring, by elevating the cord the muscle can be readily brushed down from both sides so that the cord is revealed occupying, as it were, a trough consisting of the cremaster muscle resting at its seat of origin.

When this procedure is carried out it is found that the cord is completely exposed and readily lifted out of its bed and isolated, revealing not only the cord but the hernial sac which generally lies in front. The sac may then be seized and its connection with the cord severed by blunt dissection up to the level of the internal ring and treated according to the choice of the operator. Once this is done and the cord uplifted in the usual manner, the cremaster muscle is found to be a structure of considerable dimensions, much greater than it appears when it is seen spread out over the cord and the adjacent parts. So considerable are its dimensions that it is surprising how much space it occupies.

When the two sides which have been thus isolated are uplifted, they appear about an inch or more in width and closely attached throughout to Poupart's ligament, and intimately identified with the underlying transversalis fascia. They seem to offer at once a purpose to create a substantial bed for the cord and to

reinforce a region which is commonly left unprotected, and which is frequently the seat of relapses or secondary formations of hernia.

In most cases when the hernia operation is performed the cremaster is ruthlessly detached from its connections, lacerated and uplifted with the cord rendering the process difficult not only to expose the cord, but to approach the hernial sac for its isolation. The cord is thus made large and cumbersome and difficult to dispose of easily in its new environment.

The steps of the operation are carried out as follows: The usual incision is made through the skin and superficial fascia, exposing the aponeurosis of the external oblique; the pillars of the external ring are then seized by small forceps and the aponeurosis divided in the line of its fibers from the external ring to a point beyond the situation of the internal ring, revealing the underlying structures and, more particularly, the cremaster muscle spread from one end of the incision to the other like a delicate meshwork over the structures of the cord. The cremaster muscle is then lifted up by two pairs of tissue forceps centrally over the cord at the level of the external ring and systematically divided by sharp dissection to the internal ring. The cord is then lifted by the gloved finger and the cremaster brushed from both sides until the cord is completely isolated from its bed from one end of the incision to the other. The hernial sac is then separated from the cord well up to the internal ring, care being taken that the vas deferens is separated to the highest possible level. The sac is then treated according to the operator's choice of methods, the object being to effect its complete removal so that there will be no bulging of the peritoneum.

The cord is again lifted up with a hooked retractor and deflected to the median line of the body. A series of No. 1 chromicized, interrupted catgut sutures are now passed, beginning at the internal ring and extending to the external. The first suture is passed through the cremaster muscle at its highest level from within outward and made to include a few converging fibers of the internal oblique and also a few fibers of the tissue of the

transversalis fascia in order to form a snug muscular ring for the cord. This marks the beginning of the reconstructed internal ring. Sutures are then placed at intervals of half an inch down to the external ring; each suture is made to include not only the flaps or walls of the cremaster but also a little of the tissue of the transversalis fascia. When the width of the flap of the cremaster appears to be too wide to be embraced by the suture the needle may be passed through the wall in and out twice, if need be on both sides, so that the suture when tied will blend firmly the whole substance of the cremaster muscle. Depending upon the length of the canal, five or six sutures may thus be passed.

When this maneuver is finished and the sutures tied it will be found that the muscle fills up the hollow or trough usually found when the cremaster is detached with the cord from its normal attachments. If there be present a weak area which might lend a tendency to the formation of a direct hernia in the usual situation it is thus reinforced, and it is very striking how firm and solid the support is when the cremaster is thus utilized. Palpation of its bed imparts a sense of great security to the entire floor thus formed without reference to the succeeding steps of the operation.

The next step is to approximate the internal oblique and transversalis on one side with the shelving border of Poupart's ligament on the other. The first suture consisting of the same material is passed at the internal ring slightly above the level of the first suture through the cremaster, and should include the underlying cremaster muscle. The sutures are passed from within outward. The first suture is important and has to be placed with deliberation and care. It creates a second muscular ring around the cord at its point of transit from the abdomen. By placing it at a slightly higher level than the first suture through the cremaster muscle the cord escapes from the reconstructed internal ring in an oblique direction upward, so that its tendency is to hang from the lower segment of the ring, thereby offering greater resistance to the reformation of a hernia. The

sutures are then placed at the same intervals of distance down to the external ring.

Palpation of the ring now reveals the floor for the cord firm and compact throughout, with a feeling of durability which is very striking. The greatest resistance possible would thus seem to be offered to the formation of any form of hernia, especially the direct variety, which is not infrequently the sequel of the radical operation for the relief of oblique inguinal hernia. It is an excellent practice to place an interrupted suture above the internal ring which penetrates the internal oblique on one side and the shelving border of Poupart's ligament on the other. The best way of testing the caliber of the reconstructed ring is to use the tip of the little finger, or, better still, Kocher's probe, which should snugly revolve within the new internal ring.

The last step is to replace the cord upon its new bed, and, being divested of the cremaster muscle and therefore not unwieldy, it fits closely to its surroundings. The pillars of the external ring are next grasped with forceps and so placed that when their ends are approximated they will indicate the normal situation, contour, and dimensions of the external ring. By exercising a little traction by the forceps on the pillars in an upward direction the flaps of the aponeurosis of the external oblique are elevated and a running suture is quickly placed from the upper to the lower end of the incision. The imbrication method is here available, but would seem to be unnecessary.

The external ring is tested with the tip of the finger, or Kocher's probe, in order that the operator shall feel assured that the cord will not be constricted. The fat layer is then approximated by a slender, continuous suture of iodized catgut and the skin approximated by means of an endermic suture of iodized catgut, which is never removed, the ends of the suture being wiped away on the tenth day with a pledget of gauze moistened with alcohol.

Infections are unknown with the technic followed, and recurrences are not regarded as being possible in normal individuals in the absence of infection. The rule is followed to keep the

patient in bed for twenty-one days in order that all the tissues that have been welded together anew shall be durable. The principles of this operation can be applied as well to the Girard or Ferguson operations as to the Bassini, and it has been found of special value in operations performed for the relief of direct inguinal hernia.

FUNGOUS DISEASE OF THE FOOT, OR MADURA FOOT, IN AMERICA

By RANDOLPH WINSLOW, M.D.
BALTIMORE, MD.

MADURA foot, or mycetoma, is a disease that has been known for many years as being endemic in certain localities in India, and as occurring occasionally in other parts of the world. A few cases also have been observed in America. This fungous disease is due to several varieties of vegetable growths, usually of the streptothrix family.

It occurs in three forms: the white or yellowish, the black, and the pink or red varieties. These varieties are so classified from the appearance of certain grains or particles that escape with the discharges from the sinuses that are found in the affected part. The most common form is the white, or ochroid; next in frequency is the black, or melanoid; least frequent is the red, or pink variety. The ochroid, or white, form of the disease when examined under the microscope shows fungi that resemble very closely the actinomyces, and it is probable that some at least of the reported cases are due to the ray fungus. In some of these cases, however, the granules resemble fish roe in appearance, and are probably not due to the ray fungus. The granules from the melanoid, or black, differ very materially in appearance and characteristics from those of the ochroid form, being black in color, like grains of gunpowder, and hard and resistant to pressure, while those from the ochroid variety are light in color, soft, and easily crushed. Vincent succeeded in cultivating the fungus from a case of the white variety, and Wright was

able to reproduce black masses from a case of the melanoid variety. From the observations of Wright and others it is evident that the ochroid and melanoid forms of the disease are not due to the same fungus or organism, the ochroid variety being due to a streptothrix, while the melanoid form is due to a more highly organized fungus, or hyphomycete.

Clinically mycetoma is a chronic inflammatory condition, usually, but not invariably, affecting the tissues of the foot, in which the foot becomes much enlarged, with nodular masses that break down and form sinuses, from which a thin purulent fluid escapes. In this discharge are seen pale or black bodies which, when examined microscopically, reveal the nature of the affection.

As the disease occurs generally in tropical or subtropical countries, where the people are accustomed to go bare-footed, there is often a history of some injury of the foot, such as the penetration of a thorn or splinter. The disease therefore usually begins on the sole of the foot as a small swelling, painless at first, but, as the condition progresses, becoming painful and interfering with locomotion. As the infection extends other nodules form and suppurate and cause fistulous tracts which open externally. Eventually the whole foot becomes much swollen, with a brawny, nodular induration, and with numerous fistulæ discharging a thin seropus containing the characteristic granules. The motions of the foot seem to be limited more by the inflammatory swelling of the soft parts than by destructive lesions of the bones, though a rarefying ostitis of the bones of the foot is also present. The disease never heals spontaneously but progresses slowly, without causing marked cachexia. Eventually, however, it terminates fatally unless arrested by appropriate treatment.

The conditions for which mycetoma is most likely to be mistaken are tuberculosis and sarcoma. From the former it should be discriminated by its nodular masses and brawny infiltration and its absence of fever. From sarcoma by its chronicity, its hardness, and the discharging sinuses, and from both by the characteristic granules found in the discharge from the fistulous

tracts. It has also been mistaken for elephantiasis, but its comparatively limited area and numerous sinuses should be sufficient to distinguish it from that affection.

As medical treatment is of no avail, amputation above the seat of the disease is the only remedy.

Up to the present time only 7 cases of mycetoma have been reported in the United States and Canada, 6 of these cases of the ochroid form and 1 only of the melanoid. Three of these cases occurred in Mexicans living in Texas; 1 in a French Canadian who had always lived in Canada; 1 in a young man born in Iowa, 1 in a young woman living in Kansas. J. Homer Wright, of Boston, observed the only case of the black variety that has been reported in this country, which occurred in an Italian woman who had lived in America several years. From this case he succeeded in making cultures and in reproducing black sclerotia.

As a contribution to the literature of the subject I desire to place on record the following case of fungous disease of the foot which clinically corresponds with the cases reported as examples of the ochroid form of Madura foot.

December 8, 1900, William Johnson, colored, from Easton, Maryland, entered the University Hospital, Baltimore, to be treated for an affection of the left foot and ankle, and gave the following history. He is twenty-nine years of age, unmarried, and works on a farm. His family history is unimportant. He has had measles but does not remember having had any other acute sickness. He has had gonorrhea twice, and six years ago had a sore on his penis, followed by an eruption over his body, with alopecia and pain in the limbs. He also has had a suppurating right inguinal adenitis. He uses alcohol in moderation, and both chews and smokes tobacco. About three years ago, while working on a farm, he cut his left foot with an axe. The wound was situated on the inner side of the instep, and was one inch in length and half an inch in depth. At the time of the injury he was wearing a pair of shoes that were covered with manure from the horse stables. He treated the wound himself for a while, but as it continued to get worse, he consulted a physician,

and it soon healed. About two months later an abscess formed at some distance from the original wound, which opened and gave exit to a foul pus. This abscess healed and he had no further trouble until the next summer, when another gathering about as large as a silver dollar formed, which he opened with a razor, letting out considerable pus. This sore never healed entirely, but he continued to work on the farm, ploughing, and attending to the horses. He did not have any pain in the foot except when he wore tight shoes. In January, 1900, the foot began to swell and the joints became very stiff, and a good deal of pain was felt. In February he had two sick horses under his care, both of which died. One horse had a lump under its jaw. He also cared for a sick cow in April, which likewise died. He had a sore on his foot while he was attending the sick animals, but was wearing boots at the time, though he was accustomed to go barefooted when the weather was warm.

There were no other animals sick on the place where he worked, but on an adjoining farm three horses died, which he visited twice and administered medicine to. The man's symptoms increased in severity, the foot became greatly enlarged, and locomotion gradually became impossible. He entered the Maryland General Hospital in July and was advised to have the foot amputated, to which he would not consent. He therefore returned to his home, where he continued to get worse until he entered the University Hospital in December.

On admission there was an extensive brawny swelling of the left foot extending from the tarsometatarsal junction to above the ankle, and involving the whole circumference of the foot. The skin was much indurated, and a very thin pus containing yellow particles exuded from, or could be pressed from, numerous sinuses upon the surface of the foot. A probe introduced into these sinuses did not penetrate deeply into the tissues. The motions of the foot were impaired but not obliterated, and he could impart some motion voluntarily. It appeared as if the lack of free motion was due to infiltration of the soft parts rather than to disease of the bones. No pain was felt when he kept

still, but when he bore weight on the foot it became painful. The glands in the groin were somewhat enlarged, but not greatly so. The limb above the foot was thin but not markedly atrophied. His organs were healthy and the temperature chart was practically normal, as was also the urine. An examination of his blood showed leukocytes 11,800, red cells 4,400,000. hemoglobin 80 per cent., and a slight eosinophilia.

An examination of the granules from the sinuses revealed actinomyces in abundance, but no effort was made to differentiate the special type of streptothrix present. An amputation in the middle of the leg was performed, and he made a speedy recovery.

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DISCUSSION

Dr. Charles A. Porter, Boston:

I diagnosed in the out-patient department a case of black and another case of the white variety of Madura foot. The first case I have practically cured by treating with 10 per cent. formalin, and I hope to save this foot.

Dr. Randolph Winslow, Baltimore (in closing):

I have wondered whether radium or the use of the *x*-ray would have any advantage in these cases.

THE DESTINY OF THE AMERICAN SURGICAL ASSOCIATION

By J. EWING MEARS, M.D.
PHILADELPHIA

A FEW years ago the writer read before this Association a paper entitled, "Reminiscences of the Early Days of the American Surgical Association."[1] He was moved to present this subject for the consideration and thought of the Fellows at that time as he was one of the three surviving co-founders out of forty-eight who were associated with the Founder, the eminent Professor Samuel D. Gross, in the foundation and organization of the Association.

By reason of his very close association with and friendship for the Founder, the writer felt that, more than any other of the co-founders, he understood and appreciated his purposes and intentions in founding the Association, and possessed knowledge of facts which would be of interest and value in recording its early history.

Many of these facts were important in character and detail, as they had relation to questions closely concerned with what was esteemed the propriety of organizing a body of surgeons of the country which might be hostile to the welfare of the Surgical Section of the American Medical Association and interfere with its growth and development.

The Founder was a distinguished member of the American Medical Association, and from its earliest days had taken an active interest in its work, had received its high honors, had

[1] Tr. Am. Surg. Assn.. 1908, vol. xxvi, p. 15.

participated especially in the work of the Surgical Section, knew of its needs for full and effective development and appreciated the difficulties in the way of their successful accomplishment. With this knowledge and with his extended experience as the great teacher, author, and practitioner, which gave him acquaintanceship and understanding of the professional qualifications and position of the members of the medical profession of the country who had chosen surgery as their specialty and who in the communities in which they resided were known as practitioners of this special branch of medicine, he was prepared to treat the question in just manner. Where medical institutions existed, these distinguished members of the profession had become teachers and authors, had gained for themselves honorable distinction, and their names and reputations have lived in the history of medicine of our country among the great men of the profession. The New England States, New York, Pennsylvania, Ohio, with the Middle West, the South, with Kentucky in the forefront, all were represented in the list as pioneer surgeons and contributors to the surgical history of the country which in several instances has given it distinction the world over.

Thus equipped the Founder, with far-reaching vision, believed that the organization of an independent body of surgeons would develop the work of the Surgical Section of the Medical Association and stimulate its growth; would perfect the contributions of its members; would give to its efforts distinction which it had not possessed. The condition of the Surgical Section of the Medical Association today verifies the prediction of the Founder and establishes the fact that he correctly understood its needs and appreciated to the fullest extent the effect the organization of the American Surgical Association would have upon it.

In founding the Surgical Association he had a clear perception and understanding as to the character and qualifications of the surgeons from the different parts of the country who should constitute its Fellowship. It was of paramount importance that

it should be national in character, through which plan it would bring to its meetings and include in the pages of its volumes of *Transactions* the surgical work characteristic of the different portions of the country, influenced as it would inevitably be by modes of life and climate and topographical conditions. Its work was to be general, not special, and the beginning clauses of its Constitution set forth clearly the object or purpose of its organization and the qualification of those who should be eligible for Fellowship. To give knowledge to those of the Fellows who have not had the opportunity of reading the important organic law of the Association and to refresh the memories of those who may not have cherished its terms as they deserved, the writer transcribes them and gives them place in this paper:

> "1. The object of the Association is to promote the development and growth of surgical science and the welfare of the human race.
>
> "2. Candidates eligible for election as Fellows should have made some reputation as author, teacher, practitioner or original investigator."

The By-laws prescribed the manner of government. The Fellowship to be in number one hundred, and a limited number of Honorary Fellows to be chosen from the eminent surgeons of this country, of Great Britain and the continent of Europe. The Code of Ethics of the American Medical Association was adopted to determine the proper professional standing and conduct of the Fellows of the Association. The Hippocratic oath, to which each graduate in medicine subscribes when admitted to its ranks as members of the medical profession, was the pledge of fealty offered by the candidate as his claims for approval of the Council were solicited. Careful examination of the professional work of the candidate, with study of his contributions to surgical literature, guided the Council in its decision as to his eligibility for admission to Fellowship in the Association. With this scrutiny of the Council the candidate was presented to the

Association for its suffrages. Medical politics was to take no part in deciding the result of the ballot. No elaborate ritual brought the successful candidate to the presence of the presiding officer and Fellows. Cap and gown and hood did not adorn his person in foreign imitation—he needed no such artificial proclamation of his merits—he had complied with the requirements of the organic law of the Association and was pronounced by the Council worthy of the high honor to be bestowed upon him in his nomination as a Fellow of the Association—to be ever loyal to its purposes and hostile to all acts of degradation of its integrity as the exponent of surgical science of our country.

The Association thus organized was prepared to begin its work. In its study and discussion of important surgical subjects awaiting final decision it was intended that it should be the court of last resort. A Fellow of the Association was appointed to read a paper on a subject chosen either by the Association or by himself and a number were appointed to discuss the paper presented. In this manner a systematic treatment of the subject could be obtained. Today the method employed, while not the same in detail, is similar, as is seen in the program of the present meeting. The grouping of various subjects having relation to the one which is principal, invites its exhaustive discussion. The value of this plan of treatment is unquestioned and gives it a completeness which could not be otherwise obtained. In the event of the presentation of a wide field of investigation the subject could be considered at a later meeting and the information gained by the intervening experience become a part of the treatment of the principal subject. To illustrate: The much-mooted question of "Bony Union after Intracapsular Fracture of the Neck of the Femur" was elaborately treated by one of the distinguished Fellows of the Association at a second meeting of the Association.[1] The program of the meeting today announces the reading of a paper on the

[1] Nicholas Senn, 1881–83, vol. i. p. 167.

same subject which will present the latest knowledge of the subject, the result of study and experimental investigation. In this way a solution of the vexed problem may be reached.

Also, at the second meeting, a paper[1] was read which recited the results of experimentation on animals to determine the possibility of the employment of aseptic ligatures in controlling hemorrhage in operations involving the peritoneum and the organs of the abdominal cavity, the ligatures, either of silk, silver or other material, which might be regarded as a foreign body, to be permitted to remain *in situ*. Before this time it was the rule to apply a clamp to the pedicle in ovarian tumor operations and fasten it between the edges of the abdominal incision in order to avoid hemorrhage. Ligatures applied to bleeding vessels were brought out of the cavity with the pedicle and removed, when sufficient time had elapsed, by gentle traction in the same manner as in amputation operation upon the extremities. The result of experiments which were made showed on examination that the knot of the ligature became encapsulated and in this condition remained *in situ* as a harmless body. While this paper recited experimental work not of great magnitude it demonstrated a great fact.

It is necessary only to glance at the titles of the papers printed on the program of this year's meeting of the Association to comprehend the absolute necessity of employing this form of ligature in the operations there recorded — operations great in variety and many great as well in character and importance that would be in a measure impossible of performance under the older methods.

Still further, at one of the early meetings of the Association a paper on neuralgia of the inferior dental branch of the fifth cranial nerve,[2] in which the portion in the inferior dental

[1] J. Ewing Mears: The Intraperitoneal Method of Treating the Pedicle in Ovariotomy, with a Report of Some Experiments Made, 1881–83, vol. i, p. 173.

[2] J. Ewing Mears: Study of the Pathological Changes Occurring in Facial Neuralgia, with the Report of a Case in which Three Inches of the Inferior Dental Nerve were Excised, 1884, vol. ii, p. 469. Cure of Facial Neuralgia, 1896, vol. xiv, p. 42.

canal was excised, the nerve by dissection being exposed to the foramen through which the main trunk emerges from the cranial cavity just after its distribution from the Gasserian ganglion. The dissection made in the operation demonstrated the ability to reach the ganglion without great difficulty and induced the operator to make the suggestion that inveterate attacks of trifacial neuralgia might be successfully treated by removal of the Gasserian ganglion. This suggestion was accepted as novel and of importance, and was recorded in anatomical and surgical text-books in this country and in Europe, the American Surgical Association gaining the distinction through one of its Fellows, and its volume of *Transactions* was given importance as the book of reference. It has promoted the treatment of trifacial neuralgia by surgical procedures, as is well known. The program of today's meeting contains the title of a paper which may be claimed as having a relation to the suggestion of excision of the ganglion, presenting a method of treatment of important value.

In this brief statement the attention of the Fellows is directed to the work of the Association in the beginning days. It fulfilled the tests of eligibility set forth by the founder, among them that of original investigation; it showed the important character of the subjects chosen for study and development.

In the thirty-seven years of its existence the Fellows have dealt with the great problems in surgery; have labored in effective manner to elucidate the great principles of surgical science, to take from the surgeon's knife the bane of mutilation and give to it conservative and constructive powers. Laboratory study has claimed the unremitting work of a number of the ablest and most distinguished Fellows of the Association in the effort to solve the vexed problem of the cause and treatment of the various forms of malignant disease. Knowledge of this subject grows slowly but effectively. In the near future, it is believed, the problem will receive a true solution and stop the ravages of this, thus far, unconquered disease.

In my paper on "Reminiscences of the Early Days of the

Association" attention was directed to the part the Association took in the organization of the Congress of American Physicians and Surgeons. Its action, accomplished by resolution and the formation of a committee to meet in consultation with a like committee appointed by each society or association devoted to the cultivation of the special branches of medicine, led to the formation of a Congress composed of separate bodies, a meeting of which was arranged for at intervals of three years. A central body of the Congress controlled the joint meeting of the separate bodies, which participated without the loss in any way of their autonomy. The value of the meetings of the Congress consists in most important manner in bringing together for scientific work and social intercourse the prominent members of the medical profession devoted to the study and practice of the special branches in medicine throughout the country. Its purposes are of a high order and its work has given distinction to American medicine. The successive meetings of the Congress have demonstrated the value of such organization, and the American Surgical Association is awarded the credit of its foundation.

Approaching two score years of work, the American Surgical Association can point with becoming pride to its accomplishments. In its life it has gathered into its circle of Fellowship the ablest members of the profession of medicine in Europe and America. Its tests for Fellowship were set high and the door of entrance into its ranks has been zealously and faithfully guarded.

A distinguished President of the Association in his inaugural address gave inspiring character to its Fellowship in the statement that "quality" *not* "quantity" should always be the determining factor in the selection of those who should constitute the membership of the Association.

Its thirty-four volumes of *Transactions* have builded a glorious monument of scientific surgical work which has made lasting impression on the study and practice of surgery the world over. It will stand forever as a monument to the far-reaching vision of the great Founder of the Association.

We, who control its work today, must not forget the great responsibility which rests upon us to preserve intact its organization; to maintain its high position as a separate and independent body, the exponent of American surgery; to remain ever true to our pledges of loyalty. In such manner the destiny of our great Association will be fulfilled, and we, with those who succeed us, inspired by like devotion, will become the masters of its destiny.

ENTEROSTOMY AND THE USE OF THE OMENTUM IN THE PREVENTION AND HEALING OF FISTULA

By CHARLES H. MAYO, M.D.
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The operation of enterostomy is a life-saving procedure, the necessity for which may be discussed a few hours longer than that of making a tracheotomy. When indicated it is just as much an operation of necessity or emergency as the latter. Both procedures have indications and marked limitations for obstruction which is mainly mechanical.

Obstruction of the bowels may result from the toxemia of disease, either local or general, or from adhesions or paresis due to acute or chronic local or diffuse abdominal inflammation. A loop of bowel may become caught beneath a peritoneal band formed from some old infection long since healed. Conditions often resembling intestinal obstruction may occur from reflex causes secondary to acute diseases of the kidney.

In the large majority of cases the intestinal obstruction for which the operation of enterostomy is indicated occurs during the first few days following an abdominal operation. The obstruction may be in the large or the small bowel; when in the large bowel a longer time is given for discussion as to its cause and method of treatment; the danger from toxemia is not as serious as in obstruction of the small bowel. In colonic obstruction the danger is from exhaustion or peritonitis resulting from perforation. Visible peristalsis extending irregularly over the abdomen in waves is often noted. Such peristaltic waves are

less noticeable in obstruction of the small bowel unless the obstruction is low in the ileum, and is incomplete and chronic. The danger of colonic obstruction following operation is greater when the operation has necessitated any suturing of the alimentary tract. The lower the injury in the intestine the greater the danger of infection from the suturing of the bowel because of the difference in the type of bacteria commonly found in varying portions of the intestine. In the small intestine there is the added toxemia of retained secretions and ferments which are delivered to the blood through the lymphatics without the protective influence of the liver which is exerted over the absorbed secretions of the colon (Draper).

In certain abdominal operations involving suturing of the middle or left colon an appendicostomy may be made as a safety-valve to take strains off the suture line, or a small tube may be passed into the rectum, high in the sigmoid, during the first few days following the operation for the same purpose.

After abdominal operations there is usually stasis of peristalsis during the first twenty-four hours. This follows the injury of the peritoneum and is a protective measure occurring after the perforation of ulcers, gunshot wounds, or other abdominal injury, and giving time for the formation of life-saving adhesions.

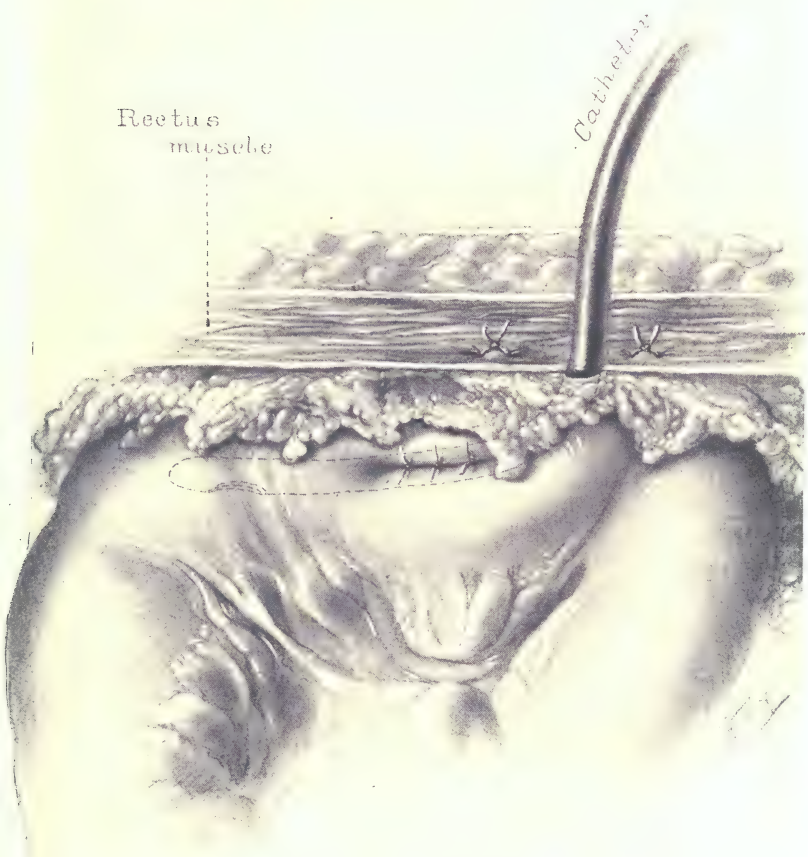
In children, abdominal operations are performed chiefly for one definite purpose and exploration is rarely indicated. In adults, the diagnosis of the essential lesion may be most accurate, yet complications or other disease may be present. It is therefore best in most cases other than acute infections to explore for associated disease even though such examinations may be the cause of additional gas colic and stasis following operation. A patient who has had an abdominal operation will probably have some stasis the same day, and it should not occasion worry if the condition persists until the next night even though it may be the cause of considerable pain. Various enemas are given the day following the operation, usually with complete relief. If the patient is not relieved, lavage laxatives, different kinds of enemas, hypodermic injections of pituitrin or eserin are given during the

second night and third day. If these do not bring relief it may be concluded that the obstruction is complete. The patient vomits and is toxic from the small bowel secretion. The evening of the third day or the morning of the fourth he is taken to the operating room, the sutures are removed, the incision opened and the abdomen inspected. When there is general peritonitis the intestines are red and inflamed or lymph-covered. In such cases an enterostomy is made without exploration. If there is no evidence of general peritonitis the hand is inserted and passed to the site of the operation, which, in acute or chronic abdominal sepsis, is usually in the pelvic or right iliac region. In the search for obstruction at this early stage the adhesion causing the condition readily gives way and the gurgling of moving gas is felt and heard. When this occurs enterostomy is not required. If operation is delayed until late in the fourth day, or even later, there may be toxic paresis as well. In some cases local abscesses are formed, but practically all patients who survive usually recover from the obstruction spontaneously, with natural movements eight days from the day of its occurrence, life having been saved by the safety-vent. Patients with obstruction beginning at a later period following operation usually present the same symptoms at the same period from the day the obstruction began. In such cases bands of adhesions are the principal factor.

Enterostomy is less favorable for diffuse peritonitis than for localized obstruction. In the colon obstruction is relieved by appendicostomy, cecostomy, colostomy or the Brown operation of ileostomy. There is rarely spontaneous recovery from obstruction of the large bowel, a second operation being required for permanent relief and the restoration of the anal function.

Technic. In early operation reopening of the incision is preferable. The advantage of this is that little or no anesthetic is required for the whole procedure. In late operation a second incision is occasionally advisable. A low-lying loop of distended bowel is elevated into the incision. A segment is freed of gases or fluids and controlled by rubber-covered forceps applied above and below the point selected for perforation. At a point opposite

the mesentery a purse-string suture of silk is applied in a diameter of half an inch. The bowel is perforated in the center of the



Tube passing through the abdominal incision opening in the omentum and into the lumen of the bowel.

purse-string by a knife or the perforation may be made by the method of J. W. Long, using the Paquelin or an electric cautery. A catheter, size 10 or 12, is inserted several inches into the intestine and held in place, after the purse-string is tied, by perforating its side with the same needle and tying it into place. This suture will hold for a few days only. It will then cut out of the tissues and may be removed with the catheter when the latter is withdrawn. Two successive purse-string sutures may be applied by the Stamm-Kader method, but the procedure most satisfactory is that of Witzel, *i. e.*, depressing the catheter into the wall of the bowel and suturing the folds formed together over the catheter for a space of an inch and a quarter. When the operation is made as a jejunostomy for feeding or for intestinal obstruction in children the Coffey method of incising the peritoneal and muscular layers of the bowel at the point of depressing the catheter into its wall conserves the lumen of the gut, the tube being placed between the mucosa and the wall of the intestine, and the peritoneum and muscle being approximated over the catheter. This method is rarely followed by a fistula. For additional security, and also to favor closure of the opening, we have passed the catheter through the perforated omentum, and then for fixation have included the parietal peritoneum, the omentum, and the intestine in three sutures. This method maintains a movable, even if adherent, intestine and the omental graft aids in closing the bowel opening by granulation.

Two unfortunate conditions may occur: (1) The loop of bowel chosen for the opening may be high in the jejunum, leaving but a limited length for nutrition; in this case rectal feeding (intravenous or subcutaneous infusions of saline) will aid until the adhesions subside and relief is obtained. (2) A fistula may occur at the point of enterostomy when it is made without the protection of the omentum. Should a fistula occur it may be blocked by inserting through it into the intestine an oblong button held by threads in the eyes or through a perforation in the obturator, which holds it up against the wall of the bowel at the point of leakage; the threads are then passed through the perforations

of a flat button on the skin side of the fistula. This method makes a closure until granulations fill the opening, when the thread can be cut and the inner button passes with the intestinal contents (Dowd, Pallister).

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TUMOR IN THE NECK

By FRED B. LUND, M.D.
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I HAD to bring this young lady to see you because I have never seen anything like it before. This patient was operated on thirty years ago by George W. Gay, for a rare tumor in the neck, and in my opinion Dr. Gay was conservative. That is, he said—here is something we do not know what it is and we had better find out. He went after it and found a small tumor the description of which is found in the note taken in the history written by Dr. John B. Walker, now of New York. This was a small tumor, and embracing the carotid, and which Dr. Gay very skilfully removed without having to tie the carotid, and you can feel in the bottom of the incision the carotid pulsating. It was a tumor of the intercarotid body. She has had no return but last fall, in November, she came back with a pulsating tumor on the other side of her neck, about the size of a small egg. I could expose the anterior end of it with some difficulty, it was surrounded by a large plexus of veins and the only way I could stop the bleeding was lifting it up, when I found it was held down by the internal carotid which passed in front of it. It resulted in ligatures of the internal and external carotid and the removal of the tumor. She has been very well. These are very serious operations and I have looked up the literature and only about eighty reported, and this is the only patient successfully operated on for both sides of the neck so far as I have been able to determine. It was owing to Dr. Gay's skill, twenty-nine years ago, in being able to shell it out without tying the carotid that my operation, twenty-nine years later, resulted in success.

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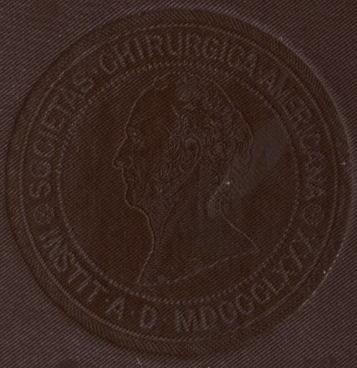
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